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Golder Associates

LETTER REPORT ON

REVIEW OF THE L-19 INVESTIGATION
POTENTIAL SOURCE OF GROUNDWATER CONTAMINATION
VICKERY, OHIO FACILITY

Submitted to:

Chemical Waste Management, Inc.
3956 State Route 412
Vickery, Ohio 43464

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March 1992

923-3370

Golder Associates Inc.

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March 25, 1992

923-3370

Mr. Steve Lonneman
Chemical Waste Management, Inc.
3956 State Route 412
Vickery, Ohio 43464

RE: LETTER REPORT ON REVIEW OF THE L-19 INVESTIGATION
POTENTIAL SOURCE OF GROUNDWATER CONTAMINATION
VICKERY, OHIO FACILITY

Dear Mr. Lonneman:

As requested in your letter to Golder Associates Inc. (Golder Associates) dated March 13, 1992, Golder Associates has reviewed the data in the L-19 Investigation Report. The review was performed primarily to evaluate potential sources of the contamination identified from analyses of groundwater samples obtained from well L-19. The lacustrine soils tested around well L-19 did not have contamination detected in them. Therefore, as previously concluded, the probable source of contamination in well L-19 is water flowing through the fill, then downward through the desiccated zone to the well screen interval. This conclusion is based on information contained in the L-19 Investigation Report and previous reports submitted to OEPA. No new information has been included in this letter report.

Background

As part of the Consent and Final Order (CAFO) entered into between the United States Environmental Protection Agency (USEPA) and Chemical Waste Management, Inc. (CWM) on April 4, 1985, a groundwater monitoring program was developed and implemented for the Vickery, Ohio, facility. Subsequently, the Ohio Environmental Protection Agency (OEPA) conducted a groundwater monitoring operation and maintenance inspection in April 1989, with a report submitted on August 28, 1989. The OEPA report stated that since the groundwater samples from monitoring well L-19 had consistently indicated the presence of 1,2-dichloroethane (1,2-DCA), this well was considered contaminated. As a result, CWM conducted an investigation of the area around L-19. The report on this investigation, dated July 24, 1990, was prepared by Golder Associates.

The groundwater monitoring program for the Vickery Facility included wells in the lacustrine materials, till materials, and the underlying bedrock materials. Each of these wells were designated L-, T-, or MR-. Therefore, well L-19 is a lacustrine well. The general location for the Vickery Facility is shown on attached Figure 1 and the approximate locations of well L-19 and investigation borings are shown on the attached Figure 2. The boring log for well L-19 and the well construction notes are also included as Attachment A to this letter report.

Geology

The site geology and hydrogeology have been extensively evaluated at the Vickery Facility. Generally, the site is underlain by about 33 feet to 52 feet of glacial overburden materials, consisting of lacustrine clay and glacial till. Underlying these overburden materials is a dolomite bedrock about 500 feet thick, which constitutes the uppermost aquifer underlying the facility. The dolomite bedrock is subsequently underlain by a sequence of sedimentary rocks comprising shales, sandstone, limestone, and dolomite. Granite bedrock ("basement rock") is encountered at a depth of about 2,900 feet beneath the ground surface. The lacustrine soils are generally encountered in the area of the active facility and have been found to vary from a depth of 0 feet to 25 feet beneath the ground surface. The typical thickness of the lacustrine soils is about 15 feet.

Surficial soils at the facility have been subject to historic desiccation, possibly to depths of 10 feet to 20 feet below the ground surface, due to water level variations and alternate wetting and drying of these materials. Thus, the materials have been consolidated, with greater degrees of consolidation near the ground surface. The depth of desiccation has been delineated by lower moisture contents, stiffer consistency, higher strength, and lower unit weight than those encountered at deeper depths in the overburden, as illustrated from the data on the attached Figures 3 and 4. Also, as shown on Figure 3, this depth is transitional. Below the level of desiccation, the lacustrine and till soils are typically soft, have a relatively high moisture content and are near normally consolidated. The softer materials are indicated by much lower standard penetration resistance, or blow counts, which generally range from 4 to 10. Figure 5 shows that elevated concentrations of tritium only penetrated to a depth of 17 feet below the ground surface. This also illustrates some connection between surface water and the desiccated zone.

Evaluation

The L-19 investigation was performed in June 1990. During this program, four boreholes were drilled around L-19, at about the location shown on Figure 2. Each boring was advanced to a depth of about 22 feet using auger drilling methods. Copies of the borehole logs are included in Attachment B. During the investigation, soil samples were collected using split spoon samplers and tested in the

field for the occurrence of organics using a Foxboro Century 128 organic vapor analyzer. The samples with the ten highest total volatile organic compound readings were sent to Environmental Testing and Certification Corporation (ETC) for analysis for 1,2-DCA. In addition, the groundwater in each of the boreholes was allowed to recover, the borehole was bailed dry, and then allowed to recover again. Each recovery period was about 24 hours. Subsequently, samples of groundwater were collected for analyses for 1,2-DCA by ETC. Details of the investigation and sampling and analyses are provided in the "Investigation at Well L-19, Vickery, Ohio, Facility" report dated June 24, 1990.

As indicated in the "Monitoring Well System, Analytical Data Evaluation, Vickery, Ohio Facility" report dated April 22, 1988, Golder Associates believes that the occurrence of 1,2-DCA in groundwater samples from well L-19 are due to localized releases associated with spills or leaks due to past waste handling practices in the area. The data do not suggest that there is evidence of overall contamination or chemical plume. The results from the L-19 investigation do not alter this evaluation. In particular, analysis of the soil samples that were obtained in the boreholes drilled around well L-19 did not indicate the presence of 1,2-DCA above the detection limits. Therefore, the presence of this compound as a contaminant in the soil samples was not demonstrated. Water samples collected from these boreholes, however, did show some presence of 1,2-DCA; concentrations were encountered up to about two parts per million. Therefore, groundwater in the vicinity of well L-19 does contain 1,2-DCA.

Lacustrine soils in the vicinity of well L-19 were encountered at depths of 9 feet to 19 feet beneath the ground surface, beneath the fill, and generally within the zone of desiccation. Well L-19 has an open interval beginning about three feet beneath the top of the lacustrine soils which is partially, or completely, within this zone of desiccation. Further, each of the boreholes that were sampled was open to the fill above the lacustrine till. As indicated in attached borehole logs, the depth to water was between three feet and eight feet beneath the ground surface. In each of these holes, the depth to lacustrine material was about seven feet beneath the ground surface. Also, in each of these holes the material became softer at a depth of about 16 feet beneath the ground surface. Finally, as shown on the sampling sheets in Attachment C the depth to water at the time of sampling was also at about three feet to eight feet beneath the ground surface. These data suggest that the source of contaminated groundwater is likely the groundwater in the fill material above the lacustrine soils. The higher blow counts in the lacustrine material above the depth of 16 feet are consistent with past information suggesting desiccation of the surface materials. Therefore, the water that is being sampled in L-19, which was sealed about 3 feet into the lacustrine material, is likely due to the short circuiting or flow from the overlying fill material downward into the well interval, possibly through desiccation cracks.

The premise of hydraulic connection of L-19 with the overlying fill material is also substantiated by past water level data collected by the site indicating higher water levels in L-19 after rainfall events. This also indicates a higher degree of connection at well L-19 than observed elsewhere in the facility. This higher degree of connection with the surface could allow communication of contaminated water in the fill with the well screen interval.

Finally, an additional suggestion that the contamination is due to localized spills, rather than from the ponds or the waste piles, is indicated by the occurrence of 1,2-DCA in well L-19 only . Based on the proximity of the wells to the ponds or the stockpile area, flows through the ground into L-14, L-15, L-16, L-20, and L-28, would be indicative of releases from the ponds. Groundwater samples from none of these wells have had 1,2-DCA detected in them. Further, if the presence of 1,2-DCA at L-19 was due to releases from the stockpile area due to consolidation of the underlying material from the height of the stockpile, contaminants should also be found in L-16 and L-26. Again, groundwater from neither of these wells has contained 1,2-DCA. Therefore, the occurrence of 1,2-DCA in groundwater samples from well L-19 is still suspected to be due to contaminants in the overlying fill.

If you have any questions, please do not hesitate to contact us.

Very truly yours,

GOLDER ASSOCIATES INC.

James F. Durrett, P.G.
Project Hydrogeologist

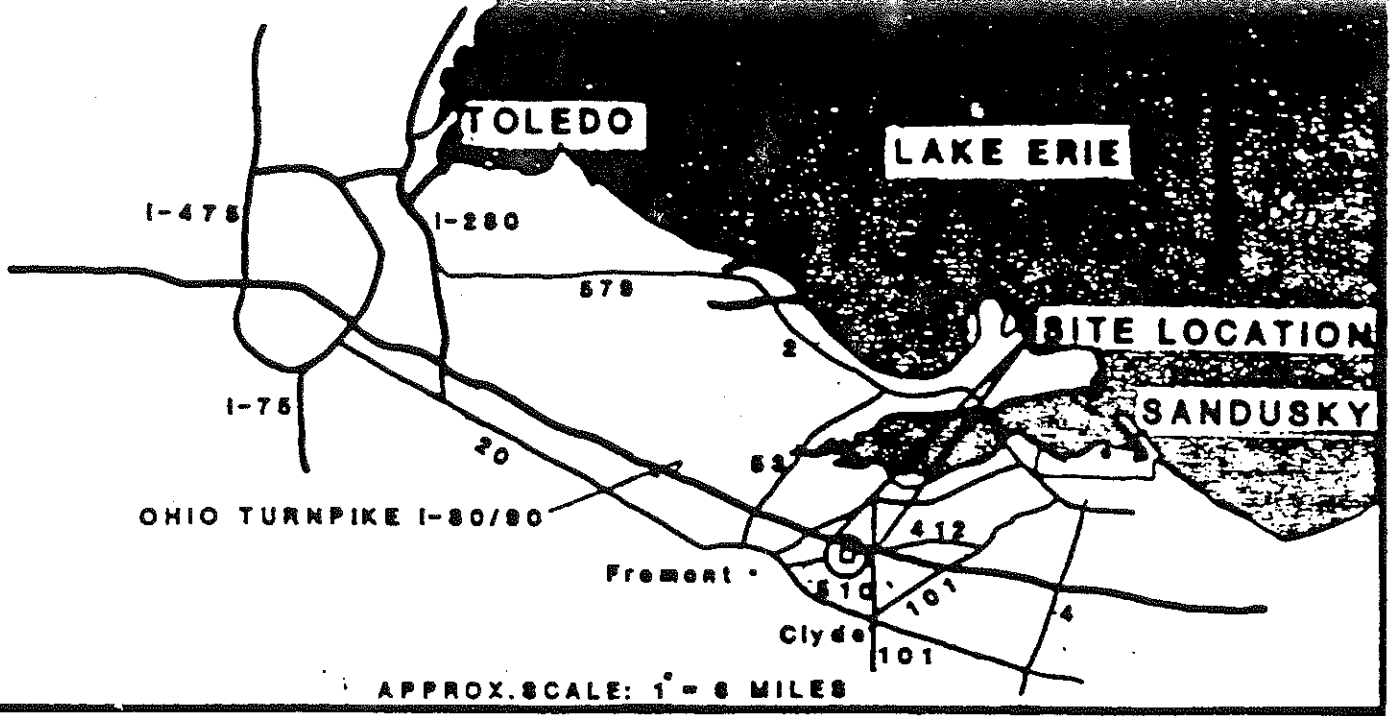
John F. Clerici, P.E.
Principal

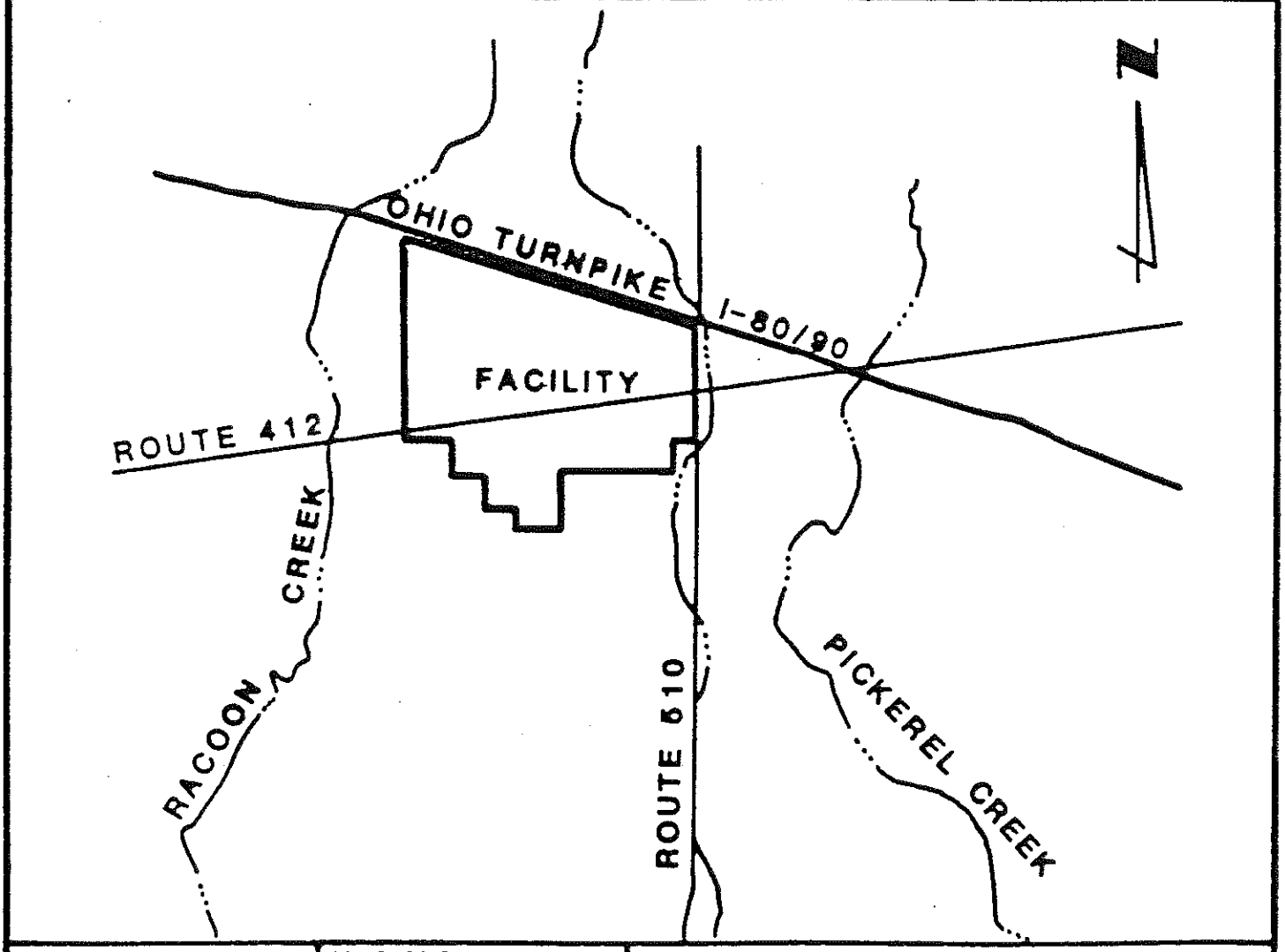
JFC:maa

ATTACHMENTS:

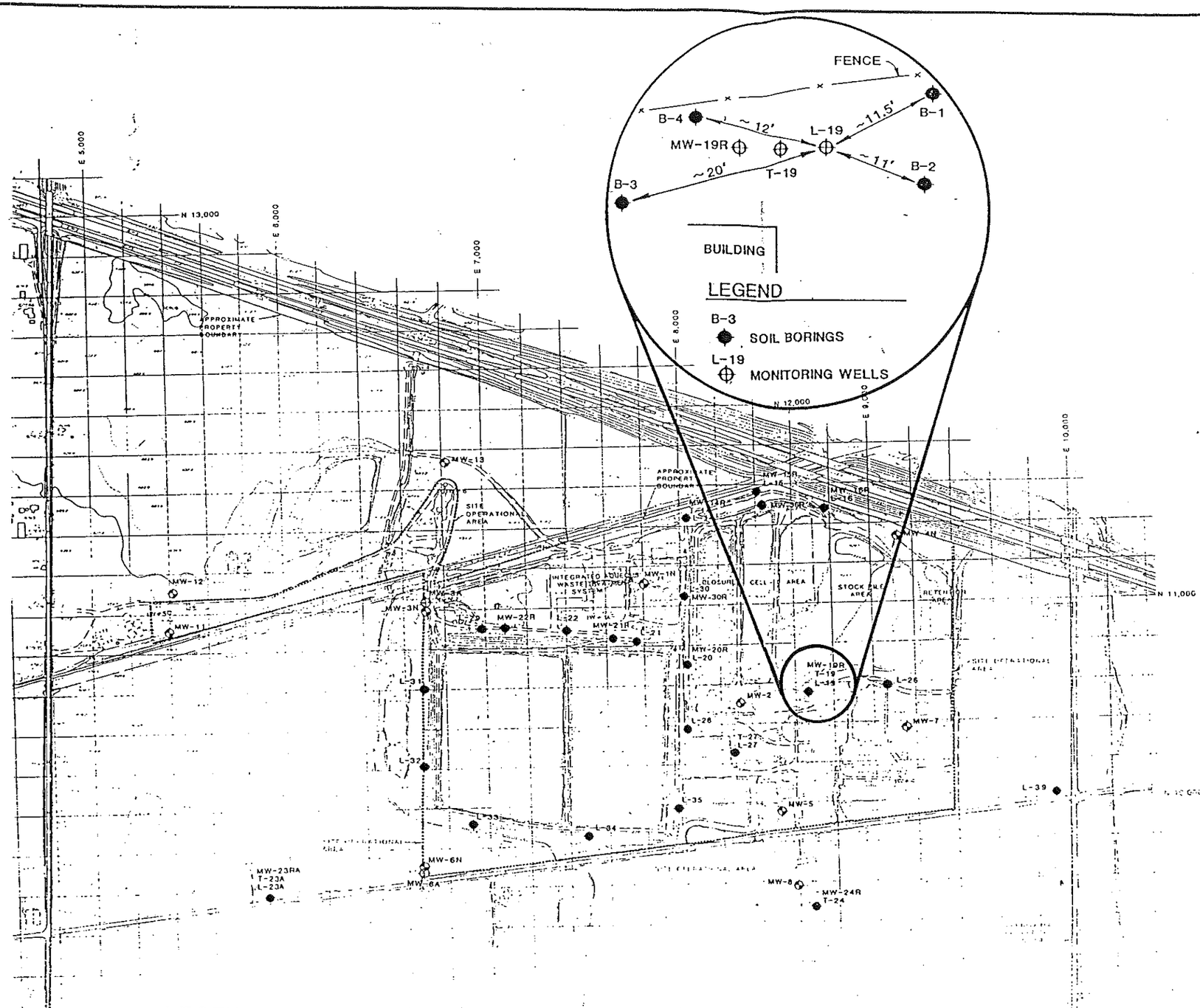
FIGURE 1 - Site Location Plan
FIGURE 2 - Well L-19 Investigation Location
FIGURE 3 - Engineering Properties of Glacial Deposits
FIGURE 4 - Shear Strength Profile for Closure Cell Area
FIGURE 5 - Tritium and Chloride Concentrations Versus Depth Below Ground Surface
ATTACHMENT A - Monitoring Well Installation Log
ATTACHMENT B - Borehole Logs
ATTACHMENT C - Chemical Analysis Data

FN: 3370REV.L19\15\MAA





JOB NO. 834-1358	SCALE NO SCALE	SITE LOCATION PLAN
DRAWN JLW	DATE 3/13/86	
CHECKED WAD	DWG. NO. 391	
Golder Associates	CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 1



NOTES:
1. BASEMAP PROVIDED BY CHEMICAL WASTE MANAGEMENT, INC. DATE OF AERIAL PHOTOGRAPHY MARCH, 1985.
2. COORDINATES ARE APPROXIMATE TO THE NEAREST 5 FEET AND ARE BASED ON FIELD LOCATIONS OF THE WELLS. IN WELL GROUPS, WELLS ARE SPACED 3 FEET APART AND ARE GIVEN THE SAME COORDINATES.
3. MW-38R, T-38 AND L-39 WELLS ARE NOT PART OF THE RCRA MONITORING SYSTEM.
4. WELL MW-1N WAS DECOMISSIONED MARCH 1988.

WELL NUMBER	EASTINGS	NORTHINGS
L-14	8,035	11,435
L-15	8,410	11,560
L-16	8,780	11,470
L-19	8,670	10,550
L-20	8,020	10,700
L-21	7,760	10,820
L-22	7,405	10,880
L-23A	5,890	9,582
L-26	9,065	10,580
L-27	8,265	10,250
L-28	8,020	10,380
L-29	6,980	10,900
L-30	8,020	11,045
L-31	6,680	10,600
L-32	6,685	10,210
L-33	6,915	9,915
L-34	7,500	9,840
L-35	7,970	9,980
L-39	9,915	10,020
MW-2	8,300	10,500
MW-5	8,515	9,950
MW-7	9,155	10,360
MW-8	8,600	9,580
MW-11	5,395	10,905
MW-12	5,400	11,105
MW-13	6,825	11,740
MW-3A	6,710	11,040
MW-6A	6,670	9,680
MW-1N	7,810	11,110
MW-3N	6,710	10,990
MW-4N	9,130	11,330
MW-6N	6,670	9,710
MW-14R	8,035	11,435
MW-15R	8,410	11,560
MW-16R	8,780	11,470
MW-19R	8,670	10,550
MW-20R	8,030	10,700
MW-21R	7,640	10,840
MW-22R	7,095	10,900
MW-23RA	5,890	9,582
MW-24R	8,680	9,475
MW-37R	9,780	8,500
MW-38R	9,780	8,495
T-14	8,035	11,435
T-19	8,670	10,550
T-23A	5,890	9,582
T-24	8,680	9,475
T-27	8,265	10,250
T-37	9,780	8,500
T-38	9,780	8,495
MW-30R	8,020	11,035
MW-36R	8,443	11,492

0 100 200 400 600 800
SCALE IN FEET

LEGEND

- EXISTING BEDROCK MONITORING WELLS
- EXISTING OVERBURDEN MONITORING WELLS
- "RCRA 265" MONITORING WELLS
- MW-19R DESIGNATES BEDROCK WELLS
- T-19 DESIGNATES TILL WELLS
- L-19 DESIGNATES LACUSTRINE WELLS

317528

Golder Associates
Atlanta, Georgia

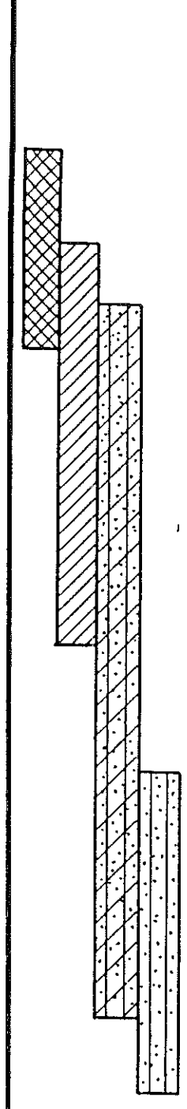
CLIENT/PROJECT
CHEMICAL WASTE MANAGEMENT, INC.

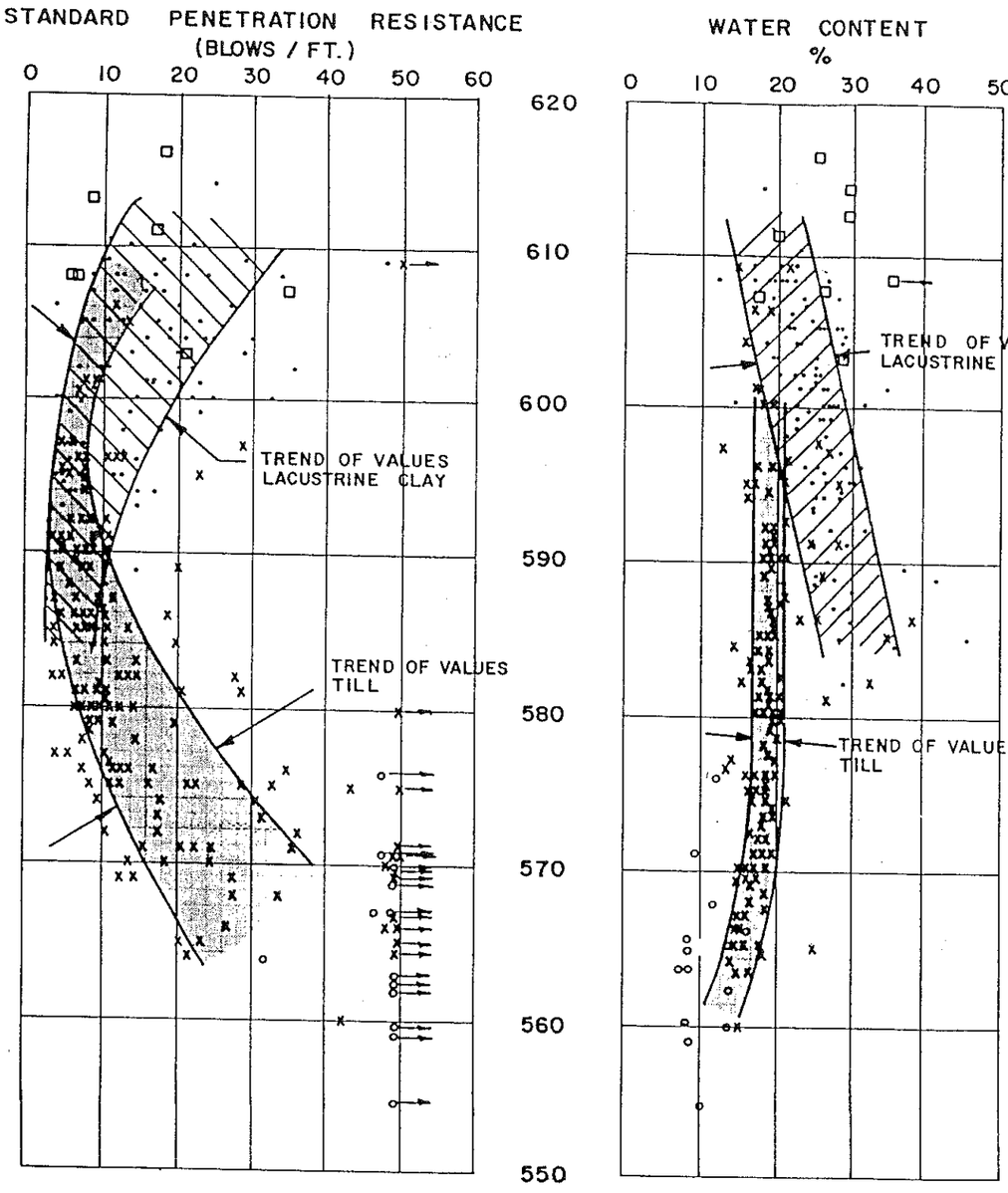
DRAWN	CHECKED	REVIEWED
JLW		

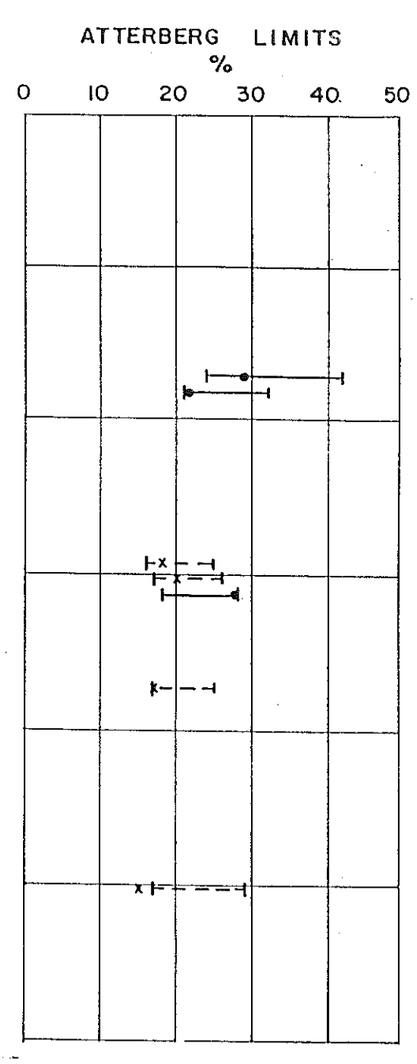
TITLE
WELL L-19 INVESTIGATION LOCATION

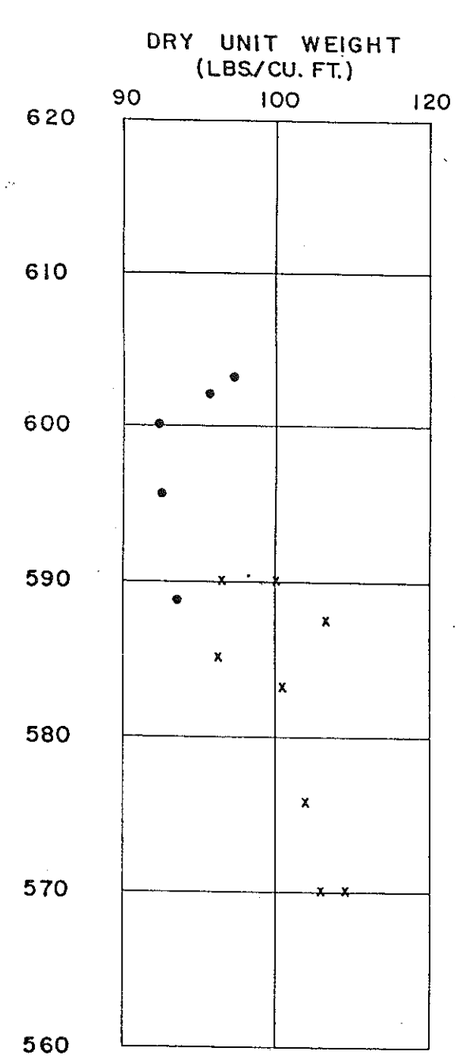
DATE	SCALE	JOB NO.
7/19/90	AS SHOWN	853-3027
FILE NO. 834-1358	DWG. NO. / REV. NO. 629	FIGURE 2

834-1358







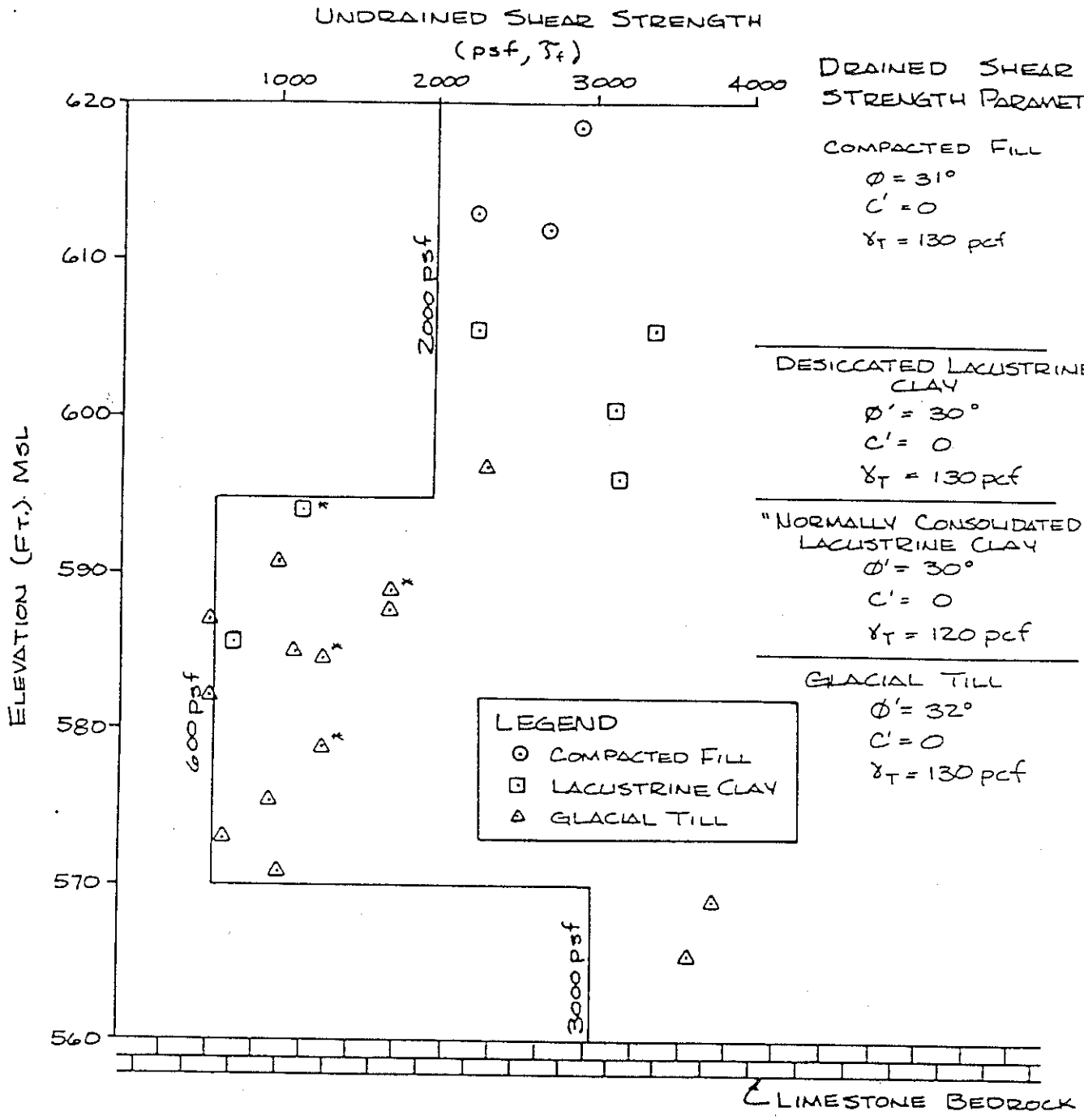


ELEVATION (FT.) MSL

STRATIGRAPHY	SYMBOL
GRAVEL TO CLAYEY SILT (FILL)	□
SOFT TO HARD BROWN TO GRAY CLAY TO CLAYEY SILT (GLACIO – LACUSTRINE CLAY)	•
SOFT TO HARD BROWN TO GRAY CLAYEY SILT, SOME SAND, TRACE GRAVEL (TILL)	x
HARD GRAY SILT, SOME SAND AND GRAVEL AND CLAY (LOWER TILL)	o

NOTE : FROM BOWSER-MORNER BORING DATA.

JOB NO. 834-1358	SCALE AS SHOWN	ENGINEERING PROPERTIES OF GLACIAL DEPOSITS	
DRAWN CAB	DATE 4-26-83		
CHECKED GJC	DWG. NO. 3		
Golder Associates		CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 3



DRAINED SHEAR STRENGTH PARAMETERS

COMPACTED FILL
$\phi = 31°$
$C' = 0$
$\gamma_T = 130$ pcf

DESICCATED LACUSTRINE CLAY
$\phi' = 30°$
$C' = 0$
$\gamma_T = 130$ pcf

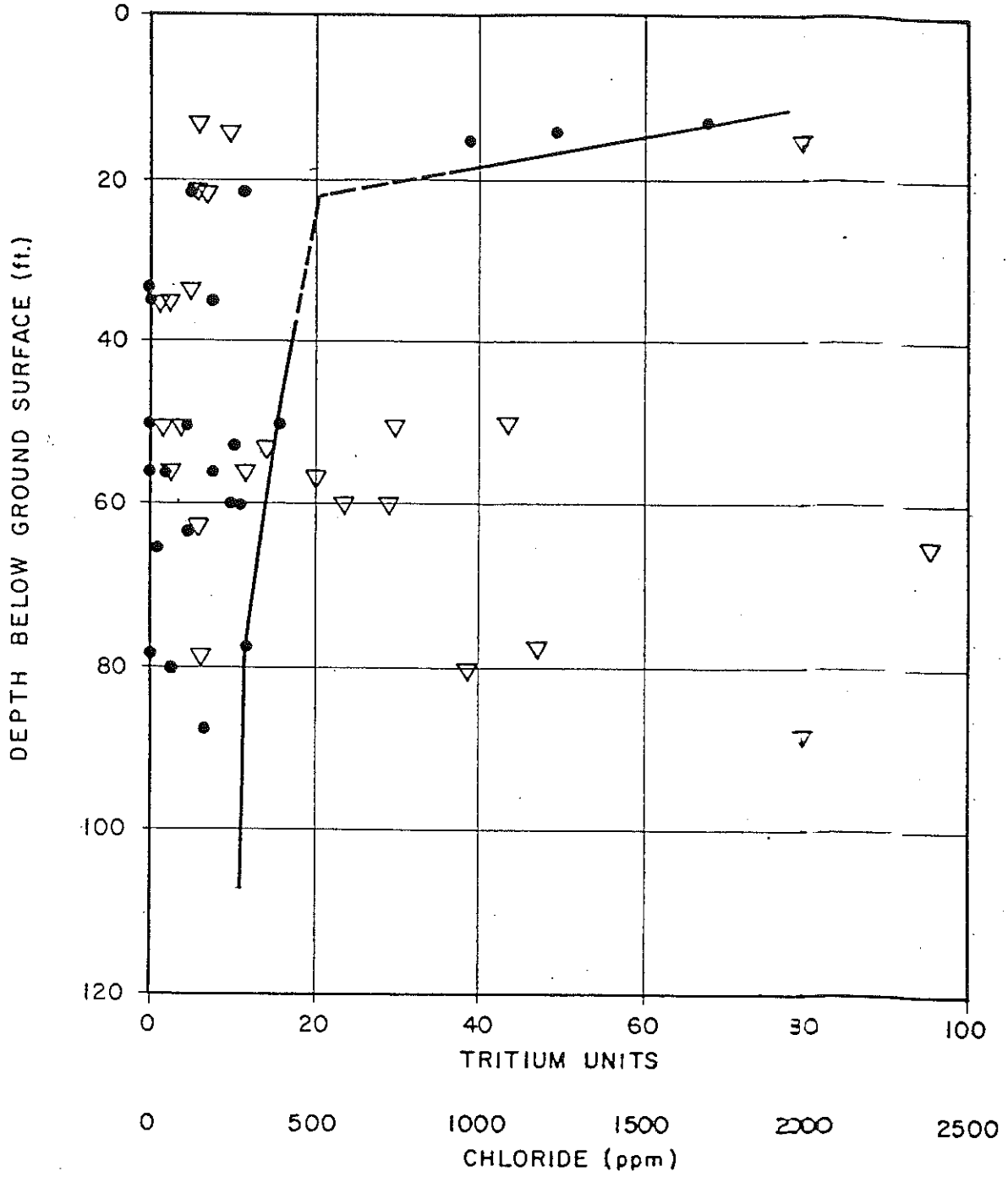
"NORMALLY CONSOLIDATED" LACUSTRINE CLAY
$\phi' = 30°$
$C' = 0$
$\gamma_T = 120$ pcf

GLACIAL TILL
$\phi' = 32°$
$C' = 0$
$\gamma_T = 130$ pcf

* FIELD VANE SHEAR TESTS DENOTED WITH AN ASTERISK MAY HAVE BEEN RUN AT A TOO STRAIN RATE YEILDING UNCONSERVATIVELY HIGH VALUES OF UNDRAINED SHEAR STRENGTH

JOB NO. 834-1358	SCALE AS SHOW	SHEAR STRENGTH PROFILE FOR CLOSURE CELL AREA
DRAWN SKB	DATE 8-23-84	
CHECKED MRB	DWG. NO. 178	
Golder Associates	CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 4

AF 20440A-B



LEGEND

——— TREND OF H_3 VALUES

– – – – INFERRED TREND OF H_3 VALUES

● TRITIUM

▽ CHLORIDE

JOB NO. 834-1358	SCALE AS SHOWN	TRITIUM AND CHLORIDE CONCENTRATIONS VERSUS DEPTH BELOW GROUND SURFACE
DRAWN SKB	DATE 12-9-83	
CHECKED MTE	DWG. NO. 84	
Golder Associates	CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 5

ATTACHMENT A

MONITORING WELL INSTALLATION LOG

MONITORING WELL INSTALLATION LOG

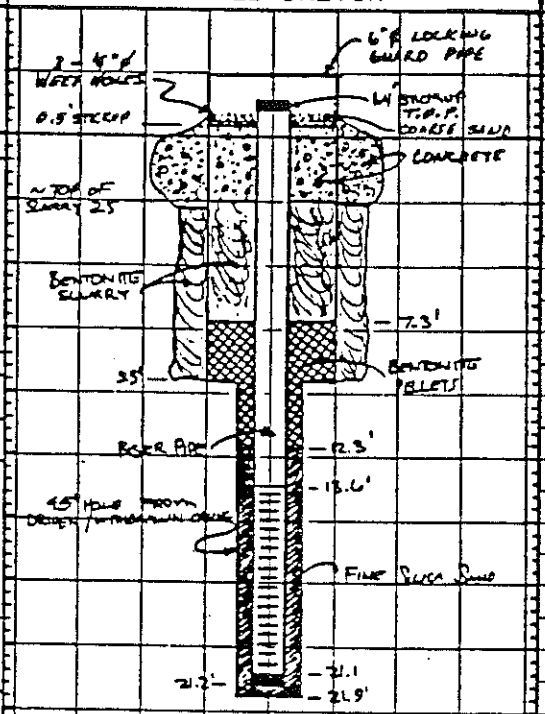
JOB NO 453-3020 PROJECT CHEM/RICKERT/IOC — WELL NO. L-19 — SHEET 1 OF 1
GA REP LF/JDC — DRILLING METHOD AUGER/ROTARY — GROUND ELEV 616.5 — WATER DEPTH 11.52'
WEATHER SUNNY — DRILLING COMPANY BOWSER MORNER — COLLAR ELEV 617.97 — DATE/TIME 10/20/95 12:00
TEMP — DRILL RIG CME 55 — DRILLER T. ROEHNER — STARTED 1015/95 (TIME / DATE) — COMPLETED 1145 10/20/95 (TIME / DATE)

MATERIALS INVENTORY

WELL CASING 2 in. dia. 15.0' LF	WELL SCREEN 2 in. dia. 7.5' LF	BENTONITE SEAL PELLETS
CASING TYPE 316 STAINLESS STEEL	SCREEN TYPE 316 STAINLESS WIRE WOUND	INSTALLATION METHOD GRAVITY FALL
JOINT TYPE FLUSH, COUPLED	SLOT SIZE 0.0060 in.	FILTER PACK QTY ~5.5 GALS
GROUT QUANTITY —	CENTRALIZERS NONE	FILTER PACK TYPE FINE SILICA SAND
GROUT TYPE BENTONITE SLURRY	DRILLING MUD TYPE NONE	INSTALLATION METHOD GRAVITY FALL

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
	GROUND SURFACE
0.0	
1.0	FIRM TO STIFF, BROWN-TAN, CLAYEY SILT, LITTLE F-C SAND, LITTLE F-C GRAVEL (FILL)
8.5	FIRM, DARK BROWN-TAN CLAYEY SILT, NEAT ORGANICS
9.4	FIRM TO STIFF, GRAY-TAN, MOTTLED, SILTY CLAY, TRACE FINE SAND (LACUSTRINE)
11.2	LOOSE TO COMPACT, BROWN SILT, SOME FINE SAND (LACUSTRINE)
12.8	SOFT TO STIFF, TAN-GRAY, LAMINATED SILTY CLAY, TRACE FINE SAND (LACUSTRINE)
19.0	SOFT TO HARD, GRAY SILTY CLAY, TRACE F-C SAND, TRACE F-C GRAVEL (TILL)
21.9	

WELL SKETCH



INSTALLATION NOTES

Attached

WL 10.1 BGS

WELL DEVELOPMENT NOTES

WELL DEVELOPED BY BAILING AND SURGING WITH 1" SS STAINLESS STEEL BAILER.

BAILER AND TEFLON CHECK VALVE WAS STEAM CLEANED AND RINSED WITH DEIONIZED WATER BEFORE DEVELOPMENT

TOTAL VOLUME REMOVED DURING DEVELOPMENT WAS APPROX. 8-9 gallons

CAPACITY OF WELL WHEN STATIC W.L. IS 11.47' (1-11-96) BELOW TOP OF RISER IS 1.8 GALS.

MEASUREMENTS DURING DEVEL.

DATE	GALLONS REMOVED	pH	SPECIFIC COND.	COMMENTS
11-15-95	2.0	6.4	7,500	
11-17-95	2.2	6.5	7,300	WATER MILKY
11-19-95	2.2	6.7	6,700	SLIGHTLY TURBID
11-24-95	2.0	—	—	RECOVERY NOT PERFORMED

STATIC W.L 1-11-96 WAS 11.47'

Golder Associates

SUBJECT: WELL INSTALLATION NOTES

Job No. 853-3020 | Made by JCC | Date 11-6-85

Ref. L-19 | Checked | Sheet 1 of 2

Reviewed GFL

1. a) Augered 10"Ø hole to 9.5' bgs. Sounded hole at 8.9'. Reaugered to 9.5' Sounded hole at 9.5'

b) Set 10' 6"Ø surface casing bottoming @ 9.5'.

c) Grouted borehole annulus (between 6" casing and 10" auger hole) with a bentonite grout slurry. Used 20 gallons of bentonite totalling ~ 5 gal overflow.

d) 6"Ø casing was drilled and flushed to 9.5 until clean. Bailed to within 0.5 of bottom of hole.

2. a) Drove 4"Ø casing from 9.5' to 15.0. Drilled and flushed clean. Sounded hole at 14.9'. Hammered casing from 14.9' to 21.9' Drilled and flushed clean. Bailed water to within 0.5 of bottom. Sounded @ 21.9

b) Pulled 4"Ø casing up a foot. Sounded at 21.9. Added 0.7' of sand. Set 7.5' screen and 13.0' of riser pipe. Stickup of riser pipe is 1.3'. (0.1 ft at end cap on bottom of screen)

c) Backfilling: 4"Ø casing was pulled up a foot at a time and added sand. Sounded each time to ensure no sloughing of hole or sand bridge had occured. Backfilled sand to 12.3' bgs. Calculated amt. sand used was ~ 5.7 gals. Sample of sand was taken.

d) 4"Ø casing was pulled up a foot and pellets were added up to 7.3', pulling up a foot at a time, and sounded to ensure no sloughing or bridging had occured. Volume of pellets used was ~ 4.4 gal. (calculated).

e) Remaining open borehole annulus was filled with bentonite slurry to ground surface.

3. a) Water level upon completion was 11.52' @ 1200 on 10/28/85

4. a) Aluminum 6"Ø Protectric flush joint pipe was threaded on to the 6"Ø surface casing and secured with a lock.

5. a) The well cap was vented by drilling a small hole in the cap.

6. a) A 30" hole was hand dug around the 6"Ø surface casing and was filled with concrete. Sloped so water would run away from well.

Golder Associates

SUBJECT WELL INSTALLATION NOTES

Job No. 955-3020 | Made by JC | Date 11-6-85

Ref. L-19 | Checked | Sheet 2 of 2

Reviewed GSC

7. a) Three ¼ diameter drain holes were drilled near top of cement mound. Bentonite grout was taken out of the 6"Ø surface casing to 2.5' below ground surface. Cement was added to replace the grout removed.

b) Coarse sand was poured on top of the hardened cement to about .5 inches below the top of well pipe.

ATTACHMENT B

BOREHOLE LOGS

Golder Associates

Field Boring Log

DEPTH HOLE 21.8'	JOB NO. 852-5027.1	PROJECT CWM/L-19 / VICKERY OHIO		BORING NO. B-1	
DEPTH SOIL DRILL 21.8'	GA INSP. LEL	DRILLING METHOD HOLLOW STEM AUGERS		SHEET 1 OF 2	
DEPTH ROCK CORE ____	WEATHER SUNNY	DRILLING COMPANY BOWSER-MORNER		SURFACE ELEV. ____	
NO. DIST. SA. ____ UD. SA. ____	TEMP. 76°F	DRILL RIG MOBILE B-61	DRILLER JIM WALSH	DATUM ____	
DEPTH WL. 6.0'	HRS. PROD. ____	WT. SAMPLER HAMMER 140 LBS	DROP 30 IN.	STARTED 1355 (hrs) 16-9-90 (Date)	
TIME WL. 1436/6-11-90	HRS. DELAYED ____	WT. CASING HAMMER ____	DROP ____	COMPLETED 1525 16-9-90	

SAMPLE TYPES

AS	AUGER SAMPLE
CS	CHUNK SAMPLE
DO	DRIVE OPEN
DS	DENISON SAMPLE
PS	PITCHER SAMPLE
RC	ROCK CORE
ST	SLOTTED TUBE
TO	THIN-WALLED, OPEN
TP	THIN-WALLED, PISTON
WS	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM
BR	BROWN	MIC	MICACEOUS
C	COARSE	MOT	MOTTLED
CA	CAVING	NP	NON-PLASTIC
CL	CLAY	OR	ORANGE
CLY	CLAYEY	ORG	ORGANIC
F	FINE	PH	PRESSURE-HYDRAULIC
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL
GL	GRAVEL	R	RED
LYD	LAYERED	RES	RESIDUAL
LI	LITTLE	RK	ROCK
SA	SAMPLE		
SAT	SATURATED		
SD	SAND		
SI	SILT		
SLY	SILTY		
SOM	SOME		
TR	TRACE		
WL	WATER LEVEL		
WH	WEIGHT OF HAMMER		
Y	YELLOW		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0-10% "SOME" 10-30%
"LITTLE" 10-20% "AND" 30-50%

RELATIVE DENSITY		BLOWS	CONSISTENCY		FIELD TEST
VERY LOOSE	VLS	0-4	VERY SOFT	VS	FISTINCHES
LOOSE	LS	4-10	SOFT	S	MEDIUM EASILY
COMPACT	CP	10-30	FIRM	FM	MOLDS
DENSE	DN	30-50	STIFF	ST	THUMB INDENTS
VERY DENSE	VDN	50	VERY STIFF	VST	THUMBNAIL INDENT
			HARD	H	RESISTS THUMBNAIL

ELEV. / DEPTH	DESCRIPTION	BLOWS/FT	SAMPLES NO.	TYPE	BLOWS PER 6 IN. OR FORCE	REC./ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
								11.4' NE of L-19
2	Firm to stiff gray to brown CLAYEY SILT to SILTY CLAY, little to some f sand, trace m-C sand, trace organic matter, (FILL)	9	1	DO	2.3.6.7	8/24		(1A) 0.0-1.6' Firm med brown CLAYEY SILT and f sand, little angular C sand, fibrous roots throughout brittle, dry. OVA head space 0.0ppm
4		15	2	DO	5.7.8.9	24/24		
6		7	3	DO	3.4.3.6	14/24		(1B) 1.6-2.0' Very stiff med brown CLAYEY SILT and f-m sand, brittle dry. F-C gravel layer at 1.8'. OVA head space 0.0ppm
8	Very stiff to stiff brown and gray CLAYEY SILT, some f sand, trace wood (LACUSTRINE).	14	4	DO	4.7.7.8	24/24		
10		17	5	DO	2.6.11.13	17/24		(2A) 2.0-3.0' Firm to stiff med brown CLAYEY SILT and f sand trace m sand, fibrous roots, brittle, dry OVA head space 0.0ppm.
12		12	6	DO	3.4.8.9	21/24		(2B) 3.0-4.0' Stiff gray and brown CLAYEY SILT and f sand, interbedded with gray and rust silt layers, dry. OVA head space 0.0ppm
14		12	7	DO	5.5.7.10	8/24		(3A) 4.0-5.0' Stiff med brown CLAYEY SILT little f sand trace angular C sand, dry OVA head space 0.0ppm
16		10	8	DO	3.4.6.8	24/24		
18		9	9	DO	2.4.5.5	24/24		(3B) 5.0-6.0' Firm med brown SILTY CLAY some f sand trace m sand, gray silt lenses, dry to moist OVA head space 0.0 ppm
20	Very soft brown to gray CLAY, little f sand gray w/c brown silt laminations (TILL)	5	10	DO	2.2.3.3	24/24		(4A) 6.0-7.0' Firm dark gray SILTY CLAY, little to some f sand, fibrous roots, slight odor, moist OVA head space 450ppm.
22	21.8' BORING TERMINATED	5	11	DO	2.2.3.4	24/24		(4B) 7.0-8.0' Firm to soft brown SILTY CLAY some f sand, red brown silt layers interbedded, moist. OVA head space 1.7ppm
								(5A) 8.0-9.0' Firm to stiff gray brown SILTY CLAY, little f sand, trace of bark, slight to moderate odor, moist. OVA head space 1000ppm.
								(5B) 9.0-10.0' Stiff SAME AS ABOVE. OVA head space 350ppm
								(6A) 10.0-11.0' Stiff brown and gray mottled CLAYEY SILT and f sand, dry to moist. OVA head space 100ppm.
								(6B) 11.0-12.0' SAME AS ABOVE OVA head space 92ppm.
								(7A) 12.0-13.0' SAME AS ABOVE OVA head space 18ppm
								(7B) 13.0-14.0' Soft SAME AS ABOVE OVA head space 36ppm
								(8A) 14.0-15.0' FIRM SAME AS ABOVE OVA head space 98ppm
								(8B) 15.0-16.0' Soft SAME AS ABOVE OVA head space 12ppm
								(9A) 16.0-17.0' Very soft gray SILTY CLAY interbedded with rust silt layers, moist OVA head space 43ppm
								CONTINUED ON NEXT PAGE

Golder Associates

Field Boring Log

DEPTH HOLE 21.8	JOB NO. 883-3027.1	PROJECT CWM / L-19 / VICKERY OHIO		BORING NO. B-1	
DEPTH SOIL DRILL 21.8'	QA INSP. LEL	DRILLING METHOD HOLLOW STEM AUGERS		SHEET 2 OF 2	
DEPTH ROCK CORE	WEATHER SUNNY	DRILLING COMPANY BOWSER-MORNER		SURFACE ELEV.	
NO. DIST. SA.	UD. SA.	TEMP. 74°F	DRILL RIG MOBILE B-61	DRILLER JIM WALSH	DATUM
DEPTH WL. 6.0'	HRS. PROD.	WT. SAMPLER HAMMER 140LBS	DROP 30 IN		STARTED 1355 / 6-9-90
TIME WL. 1430 / 6-11-90	HRS. DELAYED	WT. CASING HAMMER	DROP		COMPLETED 1525 / 6-9-90

SAMPLE TYPES

A.S.	AUGER SAMPLE	BL	BLACK
C.S.	CHUNK SAMPLE	BR	BROWN
D.O.	DRIVE OPEN	C	COARSE
D.S.	DENISON SAMPLE	CA	CASING
P.S.	PITCHER SAMPLE	CL	CLAY
R.C.	ROCA CORE	CLY	CLAYEY
S.T.	SLOTTED TUBE	F	FINE
T.O.	THIN-WALLED, OPEN	FRAG	FRAGMENTS
T.P.	THIN-WALLED, PISTON	GL	GRAVEL
W.S.	WASH SAMPLE	LYD	LAYERED
		LI	LITTLE

ABBREVIATIONS

M	MEDIUM	SA	SAMPLE
MIC	MICACEOUS	SAT	SATURATED
MOT	MOTTLED	SD	SAND
NP	NON-PLASTIC	SI	SILT
OR	ORANGE	SLTY	SILTY
ORG	ORGANIC	SM	SOME
PH	PRESSURE HYDRAULIC	TR	TRACE
PM	PRESSURE MANUAL	WL	WATER LEVEL
R	RED	WOH	WEIGHT OF HAMMER
RES	RESIDUAL	Y	YELLOW
RK	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0 1% "SOME" 12 30%
"LITTLE" 5 12% "AND" 30 50%

RELATIVE DENSITY	BLOWS	CONSISTENCY	FIELD PRESSURE
VERY LOOSE VLS	0-4	VERY SOFT VS	EXTRUDES
LOOSE LS	4-10	SOFT S	MOLDS EASILY
COMPACT CP	10-30	FIRM FM	MOLDS
DENSE DN	30-50	STIFF ST	THUMB INDENTS
VERY DENSE VDN	50	VERY STIFF VST	THUMBNAIL INDENTS
		HARD H	RESISTS THUMBNAIL

ELEV. / DEPTH	DESCRIPTION	BLOWS / FT	SAMPLES NO.	TYPE	PLASTIC BLOWS PER 6 IN (FORCE)	REC / ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
								CONTINUED FROM PAGE 1
								(9B) 17.0'-18.0' Very soft gray SILTY CLAY little f sand, rust silt layers throughout, laminated sticky OVA head space 3.2 ppm
								(10A) 18.0'-19.0' Very soft gray brown SILTY CLAY and f sand, brown f sand layers throughout, OVA head space 15 ppm
								(10B) 19.0'-20.0' Very soft gray SILTY CLAY, gray silt layers throughout, laminated sticky, plastic, moist OVA head space 6.4 ppm
								(11A) 20.0'-21.0' Very soft brown clay, trace f sand, interbedded with med brown silt layers, sticky, plastic, wet, OVA head space 17 ppm
								(11B) 21.0'-22.0' Very soft gray CLAY trace f sand, gray silt lenses throughout laminated, plastic, sticky, moist OVA head space 0.0 ppm
								21.8' Bottom of hole. Boring terminated. Water level at 17.2' at boring termination

Golder Associates

Field Boring Log

DEPTH HOLE 21.8'	JOB NO. 885-3027.1	PROJECT CWM / L-19 / VICKERY OHIO		BORING NO. B-2	
DEPTH SOIL DRILL	BA INSP. LEL	DRILLING METHOD HOLLOW STEM AUGERS		SHEET 1 OF 2	
DEPTH ROCK CORE	WEATHER CLOUDY	DRILLING COMPANY BOWSER-MORNER		SURFACE ELEV.	
NO. DIST. SA. UD. SA.	TEMP. 74° F	DRILL RIG MOBILE B-61	DRILLER JIM WALSH	DATUM	
DEPTH WL. 6.5'	HRS. PROD.	WT. SAMPLER HAMMER 140 LBS.	DROP 30 IN.	STARTED 1700 (TIME) 16-9-90 (DATE)	
TIME WL. 1435 / 6-11-90	HRS. DELAYED	WT. CASING HAMMER	DROP	COMPLETED 1835 16-9-90	

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S	CHUNK SAMPLE
D.O	DRIVE OPEN
D.S	DENISON SAMPLE
P.S	PITCHER SAMPLE
R.C	ROCK CORE
S.T.	SLOTTED TUBE
T.O	THIN-WALLED, OPEN
T.P	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BL	BLACK
BR	BROWN
C	COARSE
CA	CASING
CL	CLAY
CLY	CLAYEY
F	FINE
FRAG	FRAGMENTS
GL	GRAVEL
LYD	LAYERED
LI	LITTLE
M	MEDIUM
MIC	MICACEOUS
MOT	MOTTLED
NP	NON-PLASTIC
OR	ORANGE
ORG	ORGANIC
PH	PRESSURE-HYDRAULIC
PM	PRESSURE-MANUAL
R	RED
RES	RESIDUAL
RK	ROCK
SA	SAMPLE
SAT	SATURATED
SD	SAND
SI	SILT
SLT	SILTY
SOM	SOME
TR	TRACE
WL	WATER LEVEL
WH	WEIGHT OF HAMMER
Y	YELLOW

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0-10% "SOME" 12-30%
"LITTLE" 0-12% "AND" 30-50%

RELATIVE DENSITY	BLOWS	CONSISTENCY	FIELD PROCEDURE
VERY LOOSE VLS	0-4	VERY SOFT VS	EXTRUDES
LOOSE LS	4-10	SOFT S	MOLDS EASILY
COMPACT CP	10-30	FIRM FM	MOLDS
DENSE DN	30-50	STIFF ST	THUMB INDENTS
VERY DENSE VDN	50	VERY STIFF VST	THUMBNAIL INDENT
		HARD H	RESISTS THUMBNAIL

ELEV. / DEPTH	DESCRIPTION	BLOWS / FT	SAMPLES NO.	TYPE	WASH BLOWS OR PATH (FORCE)	REC / ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
								SEE OF L-19
2	Soft to very stiff gray to brown CLAYEY SILT to SILTY CLAY, little to some f sand, trace m-c sand, trace organic matter. (FILL).	13	1	DO	4-5-8-14	12/24		(1A) 0.0'-1.0' Stiff, brown mottled CLAYEY SILT and to some f sand little to trace m sand, dry, brittle OVA head space 0.01 ppm
4		18	2	DO	5-7-11-14	20/24		(1B) 1.0'-2.0' Stiff to very stiff med brown CLAYEY SILT, some f sand little to trace m sand, fibrous roots, dry, brittle, OVA head space 0.03 ppm
6		11	3	DO	4-5-6-9	20/24		(2A) 2.0'-3.0' Stiff to very stiff brown mottled CLAYEY SILT, some f sand fibrous roots throughout, dry, brittle OVA head space 0.00 ppm
8	Firm to stiff brown SILTY CLAY to CLAYEY SILT, little f sand, red brown silt lamination (LACUSTRINE).	9	4	DO	4-4-5-7	21/24		(2B) 3.0'-4.0' SAME AS ABOVE OVA head space 23 ppm
10		14	5	DO	3-6-8-12	22/24		(3A) 4.0'-5.0' Firm to stiff med. brown SILTY CLAY some f sand, trace c sand (angular), moist. OVA head space 42 ppm
12		14	6	DO	3-6-8-10	18/24		(3B) 5.0'-6.0' Soft to firm gray-brown, SILTY CLAY, little to some f sand trace angular med sand, moist. OVA head space [illegible] ppm
14		14	7	DO	3-6-8-10	24/24		(4A) 6.0'-7.0' Soft to stiff gray brown SILTY CLAY, little f sand, moist. OVA head space 470 ppm
16		12	8	DO	3-5-7-11	24/24		(4B) 7.0'-8.0' Soft gray SILTY CLAY, little f sand tan silt lenses throughout, traces of wood, odor moist. OVA head space 13 seconds over 1000 ppm.
18		11	9	DO	3-5-6-8	24/24		(5A) 8.0'-9.0' Firm med. brown CLAYEY SILT, some f sand interbedded with rust silt lensis, dry to moist. OVA head space 200 ppm.
20	Very soft gray SILTY CLAY to CLAY, little to trace f sand, rust silt lenses (TILL)	9	10	DO	3-4-5-6	24/24		(5B) 9.0'-10.0' Firm, mid brown, mottled SILTY CLAY, and to some f sand, mid brown f sand lenses throughout dry to moist. OVA head space 70 ppm
22	21.8 BORING TERMINATED	4	11	DO	1-2-2-4	24/24		(6A) 10.0'-11.0' Soft dark brown CLAYEY SILT, little f sand, interbedded with rust silt layers, moist. OVA head space 92 ppm.
								(6B) 11.0'-12.0' Stiff dark brown CLAYEY SILT, little f sand interbedded with rust silt layers, moist OVA head space 60 ppm.
								(7A) 12.0'-13.0' Firm dark brown CLAYEY SILT, little f sand, interbedded with rust silt layers, moist OVA head space 87 ppm
								(7B) 13.0'-16.0' Stiff mid brown SILTY CLAY and f sand, interbedded with rust f sand layers and gray silt layers OVA head space 940 ppm
								CONTINUED ON NEXT PAGE

Golder Associates

Field Boring Log

DEPTH HOLE 21.8'	JOB NO. 893-3027.1	PROJECT CKIM / L-19 / VICKERY OHIO		BORING NO. B-2	
DEPTH SOIL DRILL 21.8'	GA INSP. LEL	DRILLING METHOD HOLLOW STEM AUGERS		SHEET 2 OF 2	
DEPTH ROCK CORE	WEATHER CLOUDY	DRILLING COMPANY BONSER - MARNER		SURFACE ELEV.	
NO. DIST. SA. UD. SA.	TEMP. 74°F	DRILL RIG MOBILE B-61	DRILLER JIM WALSH	DATUM	
DEPTH WL. 6.5'	HRS. PROD.	WT. SAMPLER HAMMER 140 LBS	DROP 30 IN	STARTED 1700 16-9-90	
TIME WL. 1432 / 6-11-90	HRS. DELAYED	WT. CASING HAMMER	DROP	COMPLETED 1835 16-9-90	

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S	CHUNK SAMPLE
D.O	DRIVE OPEN
D.S	DENISON SAMPLE
P.S	PITCHER SAMPLE
R.C	ROCK CORE
S.T.	SLOTTED TUBE
T.O.	THIN-WALLED, OPEN
T.P.	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BL	BLACK
BR	BROWN
C	COARSE
CA	CAVING
CL	CLAY
CLY	CLAYEY
F	FINE
FRAG	FRAGMENTS
GL	GRAVEL
LYD	LAYERED
LI	LITTLE
M	MEDIUM
MIC	MICACEOUS
MOT	MOTTLED
NP	NON-PLASTIC
OR	ORANGE
ORG	ORGANIC
PH	PRESSURE HYDRAULIC
PM	PRESSURE MANUAL
R	RED
RES	RESIDUAL
RK	ROCK
SA	SAMPLE
SAT	SATURATED
SD	SAND
SI	SILT
SLTY	SILTY
SM	SOME
TR	TRACE
WL	WATER LEVEL
WH	WEIGHT OF HAMMER
Y	YELLOW

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0 - 5% "SOME" 12 - 30%
"LITTLE" 5 - 12% "AND" 30 - 50%

RELATIVE DENSITY	BLOWS	CONSISTENCY	FIELD PRESSURE
VERY LOOSE VLS	0-4	VERY SOFT VS	EXTRUDES
LOOSE LS	4-10	SOFT S	MOLDS EASILY
COMPACT CP	10-30	FIRM FM	MOLDS
DENSE DN	30-50	STIFF ST	THUMB INDENTS
VERY DENSE VDN	50	VERY STIFF VST	THUMBNAIL INDENTS
		HARD H	RESISTS THUMBNAIL

ELEV. / DEPTH	DESCRIPTION	BLOWS / FT	SAMPLES NO.	SAMPLES TYPE	SAMPLES HAMMER & DROP (FALL) (FORCE)	SAMPLES REC. / ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
								CONTINUED FROM PAGE 1
								(8A) 14.0-15.0' Firm mid. brown SILTY CLAY and f sand, interbedded with rust f sand layers and gray silt layers. OVA head space 20 ppm.
								(8B) 15.0-16.0' SAME AS ABOVE OVA head space 5.0 ppm
								(9A) 16.0-17.0' SAME AS ABOVE. OVA head space 9.0 ppm
								(9B) 17.0-18.0' Soft brown SILTY CLAY, some f sand, interbedded with md brown silt layers, moist. OVA head space 3.2 ppm.
								(10A) 18.0-19.0' Very soft brown SILTY CLAY to CLAY, little f sand, sticky, plastic, moist to wet. OVA head space 2.5 ppm
								(10B) 19.0-20.0' Very soft gray SILTY CLAY, little to trace f sand, laminated, sticky, plastic, moist to wet. OVA head space 1.2 ppm
								(11A) 20.0-21.0' Very soft, gray SILTY CLAY, trace f sand, layers of rust silt throughout, very sticky, plastic, laminated, wet. OVA head space 2.5 ppm
								(11B) 21.0-22.0' Very soft gray CLAY, trace f sand, plastic, sticky, laminated wet. OVA head space 0.0 ppm
								21.8' Bottom of hole. Boring terminated. Water level at 20.0' at hourly termination.

Golder Associates

Field Boring Log

DEPTH HOLE 21.8'	JOB NO. 853-3027.1	PROJECT CWM/L-19/VICKERY OHIO		BORING NO. B-3	
DEPTH SOIL DRILL 21.8	BA INSP. LEL	DRILLING METHOD HOLLOW STEM AUGERS		SHEET 1	OF 2
DEPTH ROCK CORE	WEATHER SUNNY	DRILLING COMPANY BOWSER-MORNER		SURFACE ELEV.	
NO. DIST. BA.	UD. BA.	TEMP. 64°	DRILL RIG MOBILE B-61	DRILLER JIM WALSH	DATUM
DEPTH WL. 3.4'	HRS. PROD.	WT. SAMPLER HAMMER 140 LBS	DROP 30 IN.	STARTED 0850 (am) 6-10-90	
TIME WL. 1404/6-12-90	HRS. DELAYED	WT. CASING HAMMER	DROP	COMPLETED 1110 (AM) 6-10-90	

SAMPLE TYPES

AS	AUGER SAMPLE
CS	CHUNK SAMPLE
DO	DRIVE OPEN
DS	DENISON SAMPLE
PS	PITCHER SAMPLE
RC	ROCK CORE
ST	SLOTTED TUBE
TO	THIN-WALLED, OPEN
TP	THIN-WALLED, PISTON
WS	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OR	ORANGE	SFY	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RK	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0-5% "SOME" 12-30%
"LITTLE" 5-12% "AND" 30-50%

RELATIVE DENSITY	BLOWS	CONSISTENCY	POWER PRESSURE
VERY LOOSE VLS	0-4	VERY SOFT VS	EXTRUDES
LOOSE LS	4-10	SOFT S	MOLDS EASILY
COMPACT CP	10-30	FIRM FM	MOLDS
DENSE DN	30-50	STIFF ST	THUMB INDENTS
VERY DENSE VDN	50	VERY STIFF VST	THUMBNAIL INDENT
		HARD H	RESISTS THUMBNAIL

ELEV. / DEPTH	DESCRIPTION	BLOWS / FT	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOWS PER 6 INCH (FORCE)	SAMPLES REC. / ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
0	Very loose to loose brown F-C SAND, little C gravel, little clayey silt. (FILL).	9	1	DO	2·3·6·6	9/24		SW of L-19
2		2	2	DO	2·1·1·1	18/24		(1) 0.0-2.0' Loose gray F-C SAND, little C gravel, little clayey silt, moist. OVA head space 4 ppm
4		>61	3	DO	1·1·60/1"	2/24		Note: Little recovery, therefore only one sample taken
6		8	4	DO	3·3·5·6	18/24		(2A) 2.0-3.0' Very loose brown F SAND, some to little clayey silt, trace m sand, sticky, wet. OVA head space 0.0 ppm
8	Soft to stiff mod. brown to dark gray SILTY CLAY, some to little f sand, trace f-c gravel, trace m-c sand, trace organic matter, brown silt lamination. (LACUSTRINE).	14	5	DO	2·5·9·13	15/24		(2B) 3.0-4.0' Very loose brown F SAND, trace silt, trace m sand, wet to moist, OVA head space 10 ppm
10		21	6	DO	4·9·12·17	18/24		(3A) 4.0-6.0' Very loose to very dense brown F-M SAND and f-c gravel, very wet, saturated. Hit something hard at 5.0'. OVA head space 60 ppm.
12		11	7	DO	5·5·6·11	11/24		
14		10	8	DO	3·5·5·8	24/24		Note: Hit something hard at 5.0', therefore pulled forward (west) 4', Tried to drill throughout before moving. Drilled 5', again hit something hard, could be a foundation. Decided to move 5' SW of 2ND HOLE
16		8	9	DO	4·4·4·6	24/24		
18	Very soft to firm gray CLAY with gray silt laminations. (TILL).	5	10	DO	2·2·3·4	24/24		(3B) AUGER SAMPLE FROM SECOND ATTEMPT AT 5.0' Dark gray F SAND, some clayey silt, sticky, wet, strong odor OVA head space 48 ppm.
20		6	11	DO	3·3·3·3	24/24		(4A) THIRD HOLE 6.0-7.0' Soft to firm mxd brown CLAYEY SILT and f sand, little f gravel, trace m sand, moist OVA head space 3.8 ppm.
22	21.8' BORING TERMINATED							(4B) 7.0-8.0' Firm to stiff dark gray SILTY CLAY, some f sand, fibrous roots and bark, moist, slight odor OVA head space 15 sfcoods over 1000 ppm
								(5A) 8.0-9.0' Loose brown and gray F-C SAND, little f-c gravel, turning to brown F SAND and SILT, saturated OVA head space 3.4 ppm
								(5B) 9.0-10.0' Soft to firm dark gray SILTY CLAY, some f sand, trace fibrous roots, dry to moist. OVA head space 1000 ppm
								(6A) 10.0-11.0' Very soft, dark gray SILTY CLAY, little f sand, sticky, moist OVA head space 350 ppm
								(6B) 11.0-12.0' Firm gray mottled SILTY CLAY some f sand, interbedded with rust silt layers throughout. OVA head space 140 ppm.
								CONTINUED ON NEXT PAGE

Golder Associates

Field Boring Log

DEPTH HOLE 21.8'	JOB NO. 853-3027.1	PROJECT CWM / 4-A / VICKERY DRG		BORING NO. B-3	
DEPTH SOIL DRILL 21.8'	GA INSP. LEL	DRILLING METHOD HOLLOW STEM AUGERS		SHEET 2 OF 2	
DEPTH ROCK CORE	WEATHER SUNNY	DRILLING COMPANY BOWSER-MORNER		SURFACE ELEV.	
ND. DIST. SA. UD. SA.	TEMP. 64°	DRILL RIG MOBILE B-61	DRILLER JIM WALSH	DATUM	
DEPTH WL. 3.4'	HRS PROD.	WT. SAMPLER HAMMER 140 LBS	DROP 30 IN	STARTED 0950 16-10-90	
TIME WL. 1454 / 16-12-90	HRS. DELAYED	WT. CASING HAMMER	DROP	COMPLETED 1110 16-10-90	

SAMPLE TYPES

AS	AUGER SAMPLE
CS	CHUNK SAMPLE
DO	DRIVE OPEN
DS	DENISON SAMPLE
PS	PITCHER SAMPLE
RC	ROCK CORE
ST	SLOTTED TUBE
TO	THIN-WALLED, OPEN
TP	THIN-WALLED, PISTON
WS	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OR	ORANGE	SFT	SOFT
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE-HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE-MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WOH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RK	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0-10% "SOME" 12-30%
"LITTLE" 10-20% "AND" 30-50%

RELATIVE DENSITY	BLOWS	CONSISTENCY	FIELD PRESSURE
VERY LOOSE VLS	0-4	VERY SOFT VS	EXTRUDES
LOOSE LS	4-10	SOFT S	MOLDS EASILY
COMPACT CP	10-30	FIRM FM	MOLDS
DENSE DN	30-50	STIFF ST	THUMB INDENTS
VERY DENSE VDN	50	VERY STIFF VST	THUMBNAIL INDENTS
		HARD H	RESISTS THUMBNAIL

ELEV. DEPTH	DESCRIPTION	BLOWS / FT	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOWS PER 6 IN (FORCE)	SAMPLES REC / ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
								CONTINUED FROM PAGE 1
								(7A) 12.0-13.0' Firm to stiff dark gray SILTY CLAY, little f sand, moist OVA head space 8 seconds over 1000ppm
								(7B) 13.0-14.0' Firm to stiff brown and mid gray mottled SILTY CLAY, little f sand, gray vertical weathering. OVA head space 100ppm
								(8A) 14.0-15.0' Very soft to soft dark gray SILTY CLAY, little f sand, red brown silt lenses throughout. OVA head space 140 ppm
								(8B) 15.0-16.0' Firm gray and rust mottled SILTY CLAY, little f sand, silt lenses throughout. OVA head space 35ppm.
								(9A) 16.0-17.0' Soft red brown CLAY, trace f sand, laminated, sticky, moist. OVA head space 61 ppm.
								(9B) 17.0-18.0' Stiff to firm gray and brown mottled SILTY CLAY, trace f sand, silt lenses throughout, wet to moist. OVA head space 64 ppm
								(10A) 18.0-19.0' Very soft to soft red gray CLAY, brown silt layers throughout, laminated, sticky. OVA head space 160ppm
								(10B) 19.0-20.0' SAME AS ABOVE. OVA head space 17ppm.
								(11A) 20.0-21.0' Very soft to soft gray and brown mottled SILTY CLAY, gray and brown silt lenses throughout, laminated, sticky moist OVA head space 32ppm
								(11B) 21.0-22.0 Soft to firm gray CLAY interbedded with gray silt layers, laminated, sticky, plastic, moist OVA head space 31 ppm.
								21.8' Bottom of hole. Boring terminated. Water level at 20.7' at boring termination

Golder Associates

Field Boring Log

DEPTH HOLE 21.9'	JOB NO. 953-3027.1	PROJECT CWM / L-19 / VICKERY OHIO		BORING NO. B-4	
DEPTH SOIL DRILL 21.9'	GA INSP. LEL	DRILLING METHOD HOLLOW STEM AUGERS		SHEET 1 OF 2	
DEPTH ROCK CORE —	WEATHER SUNNY	DRILLING COMPANY BOWSER-MORNER		SURFACE ELEV. —	
NO. DIST. SA. — UD. SA. —	TEMP. 74° F	DRILL RIG MOBILE B-61	DRILLER JIM WALSH	DATUM —	
DEPTH WL. 7.5'	HRS. PROD. —	WT. SAMPLER HAMMER 140 LBS	DROP 30 IN	STARTED 1315 (TIME) 16-APR-90 (DATE)	
TIME WL. 1425 / 6-12-90	HRS. DELAYED —	WT. CASING HAMMER —	DROP —	COMPLETED 1500 16-APR-90	

SAMPLE TYPES

A.S	AUGER SAMPLE
C.S	CHUNK SAMPLE
D.O	DRIVE OPEN
D.S	DENISON SAMPLE
P.S	PITCHER SAMPLE
R.C.	ROCK CORE
S.T.	SLOTTED TUBE
T.O	THIN-WALLED OPEN
T.P	THIN-WALLED, PISTON
W.S	WASH SAMPLE

ABBREVIATIONS

BL	BLACK	M	MEDIUM	SA	SAMPLE
BR	BROWN	MIC	MICACEOUS	SAT	SATURATED
C	COARSE	MOT	MOTTLED	SD	SAND
CA	CASING	NP	NON-PLASTIC	SI	SILT
CL	CLAY	OR	ORANGE	SLT	SILTY
CLY	CLAYEY	ORG	ORGANIC	SM	SOME
F	FINE	PH	PRESSURE HYDRAULIC	TR	TRACE
FRAG	FRAGMENTS	PM	PRESSURE MANUAL	WL	WATER LEVEL
GL	GRAVEL	R	RED	WH	WEIGHT OF HAMMER
LYD	LAYERED	RES	RESIDUAL	Y	YELLOW
LI	LITTLE	RK	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0-5% "SOME" 12-30%
"LITTLE" 5-12% "AND" 30-50%

RELATIVE DENSITY	BLOWS	CONSISTENCY	POCKET PENETROMETER
VERY LOOSE VLS	0-4	VERY SOFT VS	EXTRUDES
LOOSE LS	4-10	SOFT S	MOLDS EASILY
COMPACT CP	10-30	FIRM FM	MOLDS
DENSE DN	30-50	STIFF ST	THUMB INDENTS
VERY DENSE VDN	50	VERY STIFF VST	THUMBNAIL INDENT
		HARD H	RESISTS THUMBNAIL

ELEV. / DEPTH	DESCRIPTION	BLOWS/FT	SAMPLES NO.	TYPE	BLOWS PER 6 IN (HAMMER WEIGHT)	REC / ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
	Loose to very stiff brown SILTY CLAY, little to some f-m sand. (FILL).	14	1	DO	9-5-9-5	17/24		NW OF L-19
2		18	2	DO	7-8-10-17	19/24		(1A) 0.0'-1.0' Loose to compact gray F-C SAND and f-c GRAVEL, some brown silty clay, dry. OVA head space 2.6 ppm.
4		22	3	DO	6-9-13-16	19/24		(1B) 1.0'-2.0' Very stiff med. brown SILTY CLAY, little to trace f sand, gray vertical weathering, rust and gray silt lenses throughout, dry. OVA head space 41 ppm
6		12	4	DO	4-6-6-10	18/24		(2A) 2.0'-3.0' Soft, med brown SILTY CLAY some f-m sand, dry. OVA head space 35ppm
8	Soft to stiff gray SILTY CLAY, little to some f sand, trace organic matter, brown silt lamination. (LACUSTRINE).	12	5	DO	3-4-8-10	18/24		(2B) 3.0'-4.0' Very stiff med brown SILTY CLAY, little f sand, gray vertical weathering, dry. OVA head space 960 ppm
10		14	6	DO	4-6-8-10	20/24		(3A) 4.0'-5.0' Stiff to very stiff med brown SILTY CLAY, little f sand, f sand and silt layer from 4.8-5.0'. OVA head space 370 ppm
12		15	7	DO	4-6-9-12	20/24		(3B) 5.0'-6.0' Very stiff brown and red brown SILTY CLAY, little f sand, grading to dark gray SILTY CLAY, strong odor. OVA head space 910 ppm
14		11	8	DO	3-5-6-8	24/24		(4A) 6.0'-7.0' Stiff gray mottled SILTY CLAY, some f sand, rust weathering. OVA head space 450 ppm
16		10	9	DO	3-4-6-7	24/24		(4B) 7.0'-8.0' Firm dark gray SILTY CLAY some f sand, moist, strong odor. OVA head space 44 seconds over 1000 ppm
18		7	10	DO	3-3-4-5	24/24		(5A) 8.0'-9.0' Firm dark brown SILTY CLAY and to some f sand, mottled with red brown silt throughout, dry. OVA head space 19 seconds over 1000 ppm
20	Very soft gray CLAY, gray silt lamination. (FILL).	4	11	DO	1-2-2-3	24/24		(5B) 9.0'-10.0' Soft dark gray SILTY CLAY, little f sand, strong odor. OVA head space 22 seconds over 1000 ppm.
22	21.9' BORING TERMINATED							(6A) 10.0'-11.0' Firm gray mottled SILTY CLAY, little f sand, rust weathering. OVA head space 790 ppm
								(6B) 11.0'-12.0' Firm gray and rust, mottled SILTY CLAY and f sand, fibrous roots throughout. OVA head space 220 ppm
								(7A) 12.0'-13.0' SAME AS ABOVE. OVA head space 240 ppm
								(7B) 13.0'-14.0' STIFF. SAME AS ABOVE. OVA head space 64 ppm.
								(8A) 14.0'-15.0' SAME AS ABOVE. OVA head space 3 ppm
								(8B) 15.0'-16.0' SAME AS ABOVE. OVA head space 20.0 ppm
								(9A) 16.0'-17.0' SAME AS ABOVE OVA head space 7 ppm
								(9B) 17.0'-18.0' SAME AS ABOVE with gray and red brown silt lenses throughout. OVA head space 14 ppm

CONTINUED ON NEXT PAGE.

Golder Associates

Field Boring Log

DEPTH HOLE 21.9' JOB NO. 893-3027 PROJECT CWM/L-19/ VICKERY OHIO BORING NO. B-4

DEPTH SOIL DRILL 21.9' QA INSP. LEL DRILLING METHOD HOLLOW STEM AUGERS SHEET 2 OF 2

DEPTH ROCK CORE ____ WEATHER SUNNY DRILLING COMPANY BOWSER-MORNER SURFACE ELEV. ____

NO. DIST. SA. ____ UD. SA. ____ TEMP. 74° F DRILL RIG MOBILE B-61 DRILLER JIM WALSH DATUM ____

DEPTH WL. 7.8' HRS. PROD. ____ WT. SAMPLER HAMMER 140 LBS DROP 30 IN STARTED 1315 (Time) 6-10-90 (Date)

TIME WL. 1405/6-12-90 HRS. DELAYED ____ WT. CASING HAMMER ____ DROP ____ COMPLETED 1500 1670-90

SAMPLE TYPES

A.S.	AUGER SAMPLE	BL	BLACK
C.S.	CHUNK SAMPLE	BR	BROWN
D.O.	DRIVE OPEN	C	COARSE
D.S.	DENISON SAMPLE	CA	CASING
P.S.	PITCHER SAMPLE	CL	CLAY
R.C.	ROCK CORE	CLY	CLAYEY
S.T.	SLOTTED TUBE	F	FINE
T.O.	THIN-WALLED, OPEN	FRAG	FRAGMENTS
T.P.	THIN-WALLED, PISTON	GL	GRAVEL
W.S.	WASH SAMPLE	LYD	LAYERED
		LI	LITTLE

ABBREVIATIONS

M	MEDIUM	SA	SAMPLE
MIC	MICACEOUS	SAT	SATURATED
MOT	MOTTLED	SD	SAND
NP	NON-PLASTIC	SI	SILT
OR	ORANGE	SLY	SILTY
ORG	ORGANIC	SM	SOME
PH	PRESSURE-HYDRAULIC	TR	TRACE
PM	PRESSURE-MANUAL	WL	WATER LEVEL
R	RED	WOH	WEIGHT OF HAMMER
RES	RESIDUAL	Y	YELLOW
RK	ROCK		

SOIL DESCRIPTION - RANGE OF PROPORTION

"TRACE" 0 - 5% "SOME" 12 - 30%

"LITTLE" 5 - 12% "AND" 30 - 50%

RELATIVE DENSITY	BLOWS	CONSISTENCY	PORE PRESSURE
VERY LOOSE VLS	0-4	VERY SOFT VS	EXTRUDES
LOOSE LS	4-10	SOFT S	MOLDS EASILY
COMPACT CP	10-30	FIRM FM	MOLDS
DENSE DN	30-50	STIFF ST	THUMB INDENTS
VERY DENSE VDN	50	VERY STIFF VST	THUMBNAIL INDENT
		HARD H	RESISTS THUMBNAIL

ELEV. / DEPTH	DESCRIPTION	BLOWS / FT	SAMPLES NO.	SAMPLES TYPE	SAMPLES BLOWS PER 6 IN (FORCE)	SAMPLES REC / ATT	DEPTH	SAMPLE DESCRIPTION AND BORING NOTES
								CONTINUED FROM PAGE 1
								(10A) 18.0-19.0' Soft to firm brown SILTY CLAY, some f sand brown silt layers throughout, moist, OVA head space 16 ppm
								(10B) 19.8-20.0 SAME AS ABOVE OVA head space 20 ppm
								(11A) 20.0-21.0' Very soft gray CLAY, gray silt lenses throughout laminated, plastic, sticky, wet. OVA head space 12 ppm
								(11B) 21.0-22.0' SAME AS ABOVE. OVA head space 6.6 ppm
								21.9' Bottom of hole. Boring terminated. Water level at 21.8' at boring termination.

ATTACHMENT C

BOREHOLE WATER SAMPLING FORMS

ETC

FIELD PARAMETER FORM (CC2)

Form 0002
Sample Management
12/89

ETC JOB # FX1452

Sample Point [K] [B-11] (Source Code / Sample Point ID)

FIELD PROCEDURES

PURGE DATE (YY MM DD)	START PURGE (2400 Hr Clock)	ELAPSED HRS	WATER VOL IN CASING (Gallons)	VOLUME PURGED (Gallons)
90 06 10	1610	27	371.014	371.014

SAMPLING METHOD:

Sampler Type [E] — A-Submersible Pump, B-ISCO, C-Bladder Pump, D-Dipper/Bottle, E-Bailer, F-Scoop/Shovel, X-Other (SPECIFY OTHER)

Sampler Material [B] — A-Teflon, B-Metal, C-PVC, D-Plastic, X-Other (SPECIFY OTHER)

Tubing Material [ ] — A-Teflon, B-Tygon, C-Polyethylene, D-Silicon, X-Other (SPECIFY OTHER)

Sample Composited [Y/N] — Procedure/Proportions

FIELD MEASUREMENTS

Well Elevation (ft/msl)

Depth to Ground water (ft) 600

Groundwater Elevation (ft msl)

Well Depth (ft) 2180

Sample Depth (non-well) (ft)

	ph	(STD)	spec. cond.	um/cm at 25 °C	(other parameter)	value	units
1st	6.4		92100		temp (H2O)	9.2	°C
2nd							
3rd							
4th							

Sample Temp (°C)

Turbidity NTU

FIELD COMMENTS

Sample Appearance:

Weather Conditions: SUNNY WINDY 78°F

Other:

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: LORI E LUZIER (Print) Employer: GOLDER ASSOCIATES

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

6-13-90 (Date) (Signature)

ORIGINAL

ETC

FIELD PARAMETER FORM (CC2)

Form 0002
Sample Management
12/89

ETC JOB # FA4453

Sample Point [X] (Source Code) [B-12] (Sample Point I.D)

FIELD PROCEDURES

PURGE DATE (YY MM DD)	START PURGE (2400 Hr Clock)	ELAPSED HRS	WATER VOL. IN CASING (Gallons)	VOLUME PURGED (Gallons)
910616/10	1615	2.6	319.616	319.616

SAMPLING METHOD:

Sampler Type [E] — A-Submersible Pump, B-ISCO, C-Bladder Pump, D-Dipper/Bottle, E-Bailer, F-Scoop/Shovel, X-Other _____ (SPECIFY OTHER)

Sampler Material [B] — A-Teflon, B-Metal, C-PVC, D-Plastic, X-Other _____ (SPECIFY OTHER)

Tubing Material [ ] — A-Teflon, B-Tygon, C-Polyethylene, D-Silicon, X-Other _____ (SPECIFY OTHER)

Sample Composited [Y/N] _____ Procedure/Proportions

FIELD MEASUREMENTS

Well Elevation (ft/msl) _____

Depth to Ground water (ft) 65.0

Groundwater Elevation (ft msl) _____

Well Depth (ft) 21.80

Sample Depth (non-well) (ft) _____

	ph		spec. cond.		other parameter	value	units
1st	6.45 (STD)	1st	5810.0	um/cm at 25 °C	H_2O temp	61.7	°C
2nd	(STD)	2nd		um/cm at 25 °C			
3rd	(STD)	3rd		um/cm at 25 °C			
4th	(STD)	4th		um/cm at 25 °C			

Sample Temp (°C) _____ Turbidity _____ NTU

FIELD COMMENTS

Sample Appearance: _____

Weather Conditions: SUNNY WINDY 75°F

Other: _____

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: LORI E LOTIER (Print) Employer: GOLDER ASSOCIATES

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

6-13-90 (Date) _____ (Signature)

ORIGINAL

ETC

FIELD PARAMETER FORM (CC2)

Form 0002
Sample Management
12/89

ETC JOB # FAG454

Sample Point [X] (Source Code) [B1-13] (Sample Point I.D)

FIELD PROCEDURES

PURGE DATE (YY MM DD)	START PURGE (2400 Hr Clock)	ELAPSED HRS	WATER VOL IN CASING (Gallons)	VOLUME PURGED (Gallons)
910616/11	1810 10	2 4 1	4 8 . 1 9	4 8 . 1 9

SAMPLING METHOD:

Sampler Type [E] — A-Submersible Pump, B-ISCO, C-Bladder Pump, D-Dipper/Bottle, E-Bailer, F-Scoop/Shovel, X-Other (SPECIFY OTHER)

Sampler Material [B] — A-Teflon, B-Metal, C-PVC, D-Plastic, X-Other (SPECIFY OTHER)

Tubing Material [ ] — A-Teflon, B-Tygon, C-Polyethylene, D-Silicon, X-Other (SPECIFY OTHER)

Sample Composited [Y/N] — Procedure/Proportions

FIELD MEASUREMENTS

Well Elevation (ft/msl)

Depth to Ground water (ft) 3 4

Groundwater Elevation (ft msl)

Well Depth (ft) 2 1 8

Sample Depth (non-well) (ft)

	ph		spec. cond.		other parameter	value	units
1st	6 . 9 3 (STD)	1st	1 0 5 0	um/cm at 25 °C	H2O temp.	2 1 . 0	°C
2nd	(STD)	2nd		um/cm at 25 °C			
3rd	(STD)	3rd		um/cm at 25 °C			
4th	(STD)	4th		um/cm at 25 °C			

Sample Temp (°C)

Turbidity NTU

FIELD COMMENTS

Sample Appearance:

Weather Conditions: SUNNY, WINDY, 78°F

Other:

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: LORI E. LOZIER (Print) Employer: GOLDER ASSOCIATES

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

6-13-92 (Date) (Signature)

ORIGINAL

ETC

FIELD PARAMETER FORM (CC2)

Form 0002
Sample Management
12/89

ETC JOB # FIELDS

Sample Point [X] (Source Code) [B-14] (Sample Point I.D)

FIELD PROCEDURES

PURGE DATE (YY MM DD)	START PURGE (2400 Hr Clock)	ELAPSED HRS	WATER VOL IN CASING (Gallons)	VOLUME PURGED (Gallons)
910611	1820	2.5	3151.196	3151.196

SAMPLING METHOD:

Sampler Type [E] — A-Submersible Pump, B-ISCO, C-Bladder Pump, D-Dipper/Bottle, E-Bailer, F-Scoop/Shovel, X-Other (SPECIFY OTHER)

Sampler Material [B] — A-Teflon, B-Metal, C-PVC, D-Plastic, X-Other (SPECIFY OTHER)

Tubing Material [ ] — A-Teflon, B-Tygon, C-Polyethylene, D-Silicon, X-Other (SPECIFY OTHER)

Sample Composited [Y/N] (Procedure/Proportions)

FIELD MEASUREMENTS

Well Elevation (ft/msl)

Depth to Ground water (ft) 7.80

Groundwater Elevation (ft msl)

Well Depth (ft) 21.9

Sample Depth (non-well) (ft)

	ph		spec. cond.		other parameter	value	units
1st	6.55 (STD)	1st	3100	um/cm at 25°C	H2O temp	13.9	°C
2nd	(STD)	2nd		um/cm at 25°C			
3rd	(STD)	3rd		um/cm at 25°C			
4th	(STD)	4th		um/cm at 25°C			

Sample Temp (°C)

Turbidity NTU

FIELD COMMENTS

Sample Appearance:

Weather Conditions: SUNNY, WINDY, 78°F

Other:

FILTERING: Use Chain of Custody (CC1) to indicate which bottles were filtered

Sampler: LORI E. LOZIER (Print) Employer: GOLDER ASSOCIATES

I certify that sampling procedures were in accordance with applicable EPA state and corporate protocols.

6-13-91 (Date) (Signature)

ORIGINAL

A3

Golder Associates Inc.
CONSULTING ENGINEERS

REPORT ON

INVESTIGATION AT WELL L-19
VICKERY, OHIO FACILITY

Submitted to:

Chemical Waste Management, Inc.
3956 State Route 412
Vickery, Ohio 43464

DISTRIBUTION:

6 Copies - Chemical Waste Management, Inc.
2 Copies - Golder Associates Inc.

July 1990

Golder Associates Inc.
CONSULTING ENGINEERS

July 24, 1990

853-3027

Chemical Waste Management, Inc.
3956 State Route 412
Vickery, Ohio 43464

Attn: Mr. Steve Lonneman

RE: INVESTIGATION AT WELL L-19
VICKERY, OHIO FACILITY

Gentlemen:

Enclosed are six copies of the report on the Investigation at Well L-19, Vickery, Ohio Facility. We received the analytical results on July 5, so the report is due to Ohio EPA by August 5.

Golder Associates appreciates the opportunity to be of service to Chemical Waste Management at the Vickery Facility. If we may be of further service please do not hesitate to call.

Very truly yours,

GOLDER ASSOCIATES INC.

James F. Durrett
Project Hydrogeologist

JFD:maa

3027-RPT.FIN\1\MAA

TABLE OF CONTENTS

1.0 INTRODUCTION

Chemical Waste Management, Inc. (CWM) owns and operates a hazardous waste disposal facility in northern Ohio, near the town of Vickery, known as the Vickery Facility. The site is located on State Route 412 near the intersection of State Route 510, about twenty miles southwest of Sandusky, Ohio (Figure 1).

The Facility presently disposes of hazardous waste by underground injection through four deep wells. Three other deep injection wells previously used at the Facility have been plugged and abandoned. Past operations at the Facility also included the use of various ponds for the treatment and/or separation of oil residues and liquid waste for reclamation and disposal.

CWM is required, as part of the Consent Agreement and Final Order (CAFO) entered into by USEPA and CWM on April 4, 1985, to participate in a groundwater monitoring program at the Facility. The Ohio EPA conducted a Ground Water Monitoring Operation and Maintenance Inspection (O&M) during April of 1989, and submitted an O&M report to CWM on August 28, 1989. The Ohio EPA O&M report stated, in part, that since monitoring well L-19 had consistently shown the presence of 1,2-dichloroethane (1,2-DCA) in the groundwater, this well was considered contaminated. As noted in the Monitoring Well System Data Evaluation Report (Reference 1), the detection of 1,2-DCA was considered a positive result, but the presence of this compound at well L-19 was indicated to be a localized condition and not indicative of overall groundwater contamination at the Facility. In response to the Ohio EPA O&M report, CWM proposed to conduct an investigation of the area around well L-19 to determine if the well was contaminated or if 1,2-DCA was indeed present in the groundwater at this location. The Ohio EPA accepted the investigation plan, as modified in accordance with their comments (Appendix A).

This report briefly describes the geology and hydrogeology of the site, presents the L-19 investigation procedures, and presents the results of the investigation analyses. This investigation and report satisfy the alleged deficiency in compliance with OAC 3745-65-93(D)(4-5) with respect to Well L-19 as noted by Ohio EPA in the August 28, 1989, O&M report. The work was performed in accordance with the investigation plan as modified and accepted by Ohio EPA.

2.0 GEOLOGY AND HYDROGEOLOGY

2.1 General Geology

The site geology and hydrogeology have been extensively evaluated and summarized in References 2 through 8. The site is underlain by approximately 33 feet to 52 feet of glacial overburden materials, consisting of lacustrine clay and glacial till, overlying dolomite bedrock. The dolomite bedrock, which is the uppermost aquifer underlying the site, is about 500 feet thick. The dolomite bedrock is underlain by a sequence of sedimentary rocks comprising shale, sandstone, limestone, and dolomite. Precambrian granite bedrock ("basement rock") is encountered about 2,900 feet beneath the ground surface.

2.2 Overburden Soils

The overburden soils at the site are the only materials of concern in this investigation. The overburden soils consist of deposits of glacial and lacustrine silty clays and clays, approximately 50 feet thick. The upper 5 feet to 10 feet of the overburden have been desiccated during the geologic past resulting in fractures which may be open, although none were observed during any of the field sampling programs.

The lacustrine soils extend from the ground surface to depths of 0 feet to 25 feet beneath the ground surface, with a typical thickness of about 15 feet. Sand partings and horizontal laminations ¼-inch to 1-inch thick have been observed in the lacustrine materials.

Glacial till deposits underlie the lacustrine materials down to bedrock. These till deposits are also comprised of silty clays and clays, with some sand and gravel in the matrix. In some areas of the site, where the lacustrine deposits are thin or absent, the till deposits are at or near the ground surface.

The depth of desiccation can be delineated by lower moisture contents and stiffer consistency than those found deeper in the overburden. Below the limit of desiccation the lacustrine and till soils are typically soft, have a relatively high moisture content, and are near normally consolidated.

2.3 Hydrogeology

The primary aquifer underlying the site is the fractured and solutioned dolomite bedrock. Site water level data indicate on-site pumping from the aquifer can affect the overall groundwater gradients. Furthermore, an on-site pump test, along with past water level data, has clearly demonstrated that local lateral flow in the aquifer can be maintained toward the facility. Regional lateral flow in the aquifer is north toward Lake Erie.

Water levels in the bedrock aquifer, within the area of this study, are approximately at an elevation of 595 feet, about 15 feet to 20 feet beneath the original ground surface. Water levels in the overburden materials have been observed to be within 5 feet of the original ground surface. Therefore, there is a component flow from the overburden material toward the bedrock aquifer. The vertical and lateral flow velocities in the overburden are estimated using the equation for average linear groundwater velocity,

$$V = \frac{ki}{n_e}$$

where V = velocity
k = hydraulic conductivity
i = hydraulic gradient
n_e = effective porosity

The vertical hydraulic conductivity (k) of the overburden materials has been estimated to be 2×10^{-8} cm/s (2×10^{-2} ft/yr) (Reference 4). Using a nominal thickness of 50 feet for the overburden and a groundwater head difference of 10 feet between the overburden and the bedrock (Reference 4), the vertical hydraulic gradient (i) is

calculated as 0.2 ft/ft. The effective porosity (n_e) of the overburden materials is taken as 0.1 (Reference 4). The vertical flow velocity is, therefore, estimated to be on the order of 0.04 ft/yr.

The lateral hydraulic conductivity (k) of the lacustrine soils has been estimated to be 1×10^{-7} cm/s (1×10^{-1} ft/yr) (Reference 4). Using a lateral hydraulic gradient (i) within the lacustrine materials of 1×10^{-4} ft/ft, calculated from groundwater elevations measured January 14, 1986, between lacustrine monitoring wells L-15 and L-23, and an effective porosity (n_e) of 0.1, the lateral flow velocity is estimated to be on the order of 0.0001 ft/yr, generally to the northwest. Vertical flow, therefore, dominates lateral flow, as vertical flow rates are two orders of magnitude greater than lateral flow rates.

3.0 INVESTIGATION PROCEDURES

The field work for the investigation around L-19 was carried out by Golder Associates Inc. (Golder Associates) between June 9 and June 10, 1990. During this period, four boreholes were drilled around L-19 at the locations shown on Figure 2. The boreholes were advanced to depths of about 22 feet below ground surface using a Mobile B-61 drill rig supplied and operated by Bowser-Morner. In each borehole, standard penetration tests were carried out at 2-foot intervals and soil samples were obtained using conventional split-spoon sampling equipment. Copies of the borehole logs are included in Appendix B.

Each of the soil samples obtained during the investigation was split into 40-ml VOA vials and one-pint glass jars. The one-pint glass jar samples were covered with foil, shaken, and allowed to sit for approximately 15 minutes. The total volatile organic concentration (TVOC) within the jar headspace was then measured using a Foxboro Century 128 OVA. After the completion of all the boreholes, the 40-ml samples corresponding to the ten highest TVOC readings were packed in ice and sent to Environmental Testing and Certification Corporation (ETC) for analysis for 1,2-DCA.

Following completion, each borehole was left open and covered with plastic. This was to keep surface water from entering the borehole and to permit the static water level to return in the boreholes in order to obtain water samples. Each borehole remained open for at least 24 hours to allow the water levels to recover. At this time, the water level was measured and the borehole was purged dry with a 3-inch PVC bailer. Following the purging, the boreholes were again covered with plastic for at least 24 hours to let the water level recover. At this time, water samples were collected using a 2-inch stainless steel bailer. The water from each borehole was poured into two 40-ml VOA vials. A field bank and a sample of water used during drilling were also obtained. The samples were packed in ice and shipped to ETC for analysis for 1,2-DCA. After

the completion of water sampling, the boreholes were backfilled with bentonite pellets to within 6 inches to 1 foot below the ground surface. The boreholes were then topped off with topsoil.

The field work was supervised by a Golder Associates engineer who established the locations of the boreholes in the field, directed the drilling operations, logged the boreholes, conducted the sampling, and handled the samples for transport to the laboratory following chain-of-custody procedures included in the approved investigation plan.

4.0 INVESTIGATION RESULTS

4.1 Stratigraphy

The soils encountered in the four boreholes consisted of fill materials overlying lacustrine deposits which overlie till deposits. In general, approximately seven feet of fill, comprising silty clay with sand, were present at each borehole location. Underneath the fill was the original ground surface, marked by roots and wood debris in a clayey silt matrix. Lacustrine deposits of clayey silt, wood and other organic matter extend to a depth of approximately 19 feet, where a very soft gray silty clay, marking the top of the till deposits, is encountered. This stratigraphy is verified by comparison with the logs for wells L-19, T-19 and MW-19R (Appendix C).

4.2 Field Screening of Soil Samples

All soil samples were screened in the field to measure the TVOC within the soil to select the ten soil samples with the highest TVOC readings for analysis by an independent analytical laboratory (ETC). The TVOC readings are indicated on the borehole logs and are tabulated in Table 1.

4.3 Chemical Analysis of Soil Samples

Ten soil samples were selected for analysis for 1,2-DCA by ETC as follows: one sample from borehole B-1, two samples from borehole B-2, three samples from borehole B-3, and four samples from borehole B-4. Table 2 presents a summary of the soil sample information and the ETC analytical results. The laboratory test results are provided in Appendix D.

No 1,2-DCA was detected in any of the soil samples.

4.4 Chemical Analysis of Water Samples

The groundwater samples which were collected from the four boreholes were sent to ETC for analysis for 1,2-DCA. In addition to these samples, a sample of the water used during drilling and a field blank sample were also sent for analysis. Table 3 presents a summary of the results of the water sample analytical results. The laboratory test results are provided in Appendix D.

Samples from boreholes B-1, B-2 and B-4 contained 1,2-DCA at concentrations of 1660 µg/l, 159 µg/l and 34 µg/l, respectively. The sample from borehole B-3, the drilling water sample and the field blank had no 1,2-DCA detected.

5.0 CONCLUSIONS

The analyses of groundwater at Well L-19 and in the boreholes B-1, B-2 and B-4, located northwest, northeast and southeast of Well L-19, detected the presence of 1,2-DCA. This compound was not detected in the groundwater sample from borehole B-3, located southwest of Well L-19. In addition, no 1,2-DCA has been detected in any sample from any other site well, including Wells T-19 and MW-19R, which are located four feet and eight feet west of L-19 and screened below L-19. Analytical results from the soil samples from boreholes B-1 through B-4 from above and below the water table did not indicate the presence of 1,2-DCA. It is likely that the TVOC readings measured in the field are due to the decomposition of organic debris at the natural ground surface.

As noted in the Monitoring Well System Analytical Data Evaluation Report (Reference 1), Well L-19 was located in an area of surface fill near the location of old sumps and transfer lines. The logs for wells L-19, T-19 and MW-19R indicated 8.5 feet of fill in this area. Similar depths of fill were also noted in boreholes B-1 through B-4.

The hydrogeologic and analytical data for Wells L-19, T-19 and MW-19R and the results of this investigation program continue to suggest a localized condition around Well L-19 to be the cause of the presence of 1,2-DCA in this area. This compound has not migrated downward, as evidenced by the T-19 and MW-19R monitoring results. Lateral migration of 1,2-DCA in the area is expected to be minimal because of the low lateral groundwater flow velocity. This is confirmed by the absence of 1,2-DCA in borehole B-3, Well L-26, and in hole SS-10 and surrounding SS-10 investigation holes (Reference 9).

Previous monitoring results from Well L-19 indicate little variation in concentration of 1,2-DCA (Table 4). This suggests a localized, static situation at Well L-19. Consequently, based on

the investigation results, Well L-19 appears to be reasonably located to continue to monitor the presence and potential variations in concentration of 1,2-DCA in the groundwater in this area.

GOLDER ASSOCIATES INC.

James F. Durrett
Project Hydrogeologist

Gary H. Collison, P.E.
Principal

JFD/GHC:maa

3027-RPT.FIN\1\MAA

REFERENCES

1. Golder Associates, "Monitoring Well System, Analytical Data Evaluation, Vickery, Ohio Facility," April 1988.

2. Bowser-Morner, Inc., "Hydrogeologic Assessment, Northern Ohio Treatment Facility, Vickery, Ohio," May 1983.

3. Golder Associates, "Geotechnical and Geohydrologic Data Review, Vickery, Ohio, Chemical Waste Management Facility," June 1983.

4. Golder Associates, "Summary and Characterization of Site Geohydrologic Conditions, Chemical Waste Management, Inc., Vickery, Ohio Facility," September 1983.

5. Golder Associates, "Groundwater Monitoring Program, CWM Northern Ohio Treatment Facility, Vickery, Ohio," April 1984.

6. Golder Associates, "Overburden Groundwater Testing Program Description," June 1984 and Addendum dated July 2, 1984.

7. Golder Associates, "Overburden Groundwater Testing Program, Vickery, Ohio Facility," September 1984.

8. Golder Associates, "Monitoring Program Hydrogeologic Study, Chemical Waste Management, Inc., Vickery, Ohio Facility," July 1986.

9. Golder Associates, "Investigation at Hole SS-10, Vickery, Ohio Facility," January 1989.

JULY 1990

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TABLE 1

RESULTS OF FIELD SCREENING OF SOIL SAMPLES FOR VOLATILE ORGANIC COMPOUNDS

BOREHOLE B-1			BOREHOLE B-2			BOREHOLE B-3			BOREHOLE B-4		
SAMPLE	DEPTH (FT)	TVOC (PPM)	SAMPLE	DEPTH (FT)	TVOC (PPM)	SAMPLE	DEPTH (FT)	TVOC (PPM)	SAMPLE	DEPTH (FT)	TVOC (PPM)
1A	0-1.6	0	1A	0-1	0	1	0-2	4.8	1A	0-1	2.6
1B	1.6-2	0	1B	1-2	0	2A	2-3	0	1B	1-2	41
2A	2-3	0	2A	2-3	0	2B	3-4	10	2A	2-3	35
2B	3-4	0	2B	3-4	23	3A	4-6	60	2B	3-4	460
3A	4-5	0	3A	4-5	42	3B	5	48	3A	4-5	370
3B	5-6	0	3B	5-6	880	4A	6-7	3.8	3B	5-6	910
4A	6-7	450	4A	6-7	470	4B	7-8	>1000	4A	6-7	450
4B	7-8	1.7	4B	7-8	>1000	5A	8-9	3.4	4B	7-8	>1000
5A	8-9	1000	5A	8-9	200	5B	9-10	1000	5A	8-9	>1000
5B	9-10	350	5B	9-10	70	6A	10-11	350	5B	9-10	>1000
6A	10-11	100	6A	10-11	92	6B	11-12	140	6A	10-11	790
6B	11-12	95	6B	11-12	60	7A	12-13	>1000	6B	11-12	220
7A	12-13	18	7A	12-13	87	7B	13-14	100	7A	12-13	240
7B	13-14	36	7B	13-14	9	8A	14-15	140	7B	13-14	64
8A	14-15	98	8A	14-15	20	8B	15-16	35	8A	14-15	36
8B	15-16	12	8B	15-16	5	9A	16-17	61	8B	15-16	20
9A	16-17	43	9A	16-17	9	9B	17-18	64	9A	16-17	71
9B	17-18	3.2	9B	17-18	3.2	10A	18-19	100	9B	17-18	14
10A	18-19	15	10A	18-19	2.5	10B	19-20	17	10A	18-19	16
10B	19-20	6.4	10B	19-20	1.2	11A	20-21	73	10B	19-20	20
11A	20-21	17	11A	20-21	2.5	11B	21-22	31	11A	20-21	12
11B	21-22	0	11B	21-22	0.1				11B	21-22	6.6

NOTE: TVOC MEANS TOTAL VOLATILE ORGANIC COMPOUNDS

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TABLE 3
SUMMARY OF BOREHOLE GROUNDWATER CHEMICAL ANALYSIS RESULTS

	BOREHOLE B-1	BOREHOLE B-2	BOREHOLE B-3	BOREHOLE B-4
Concentration of 1,2-dichloroethane (1,2-DCA) (ppb)	1660	159	ND	33.67

NOTE: ND MEANS NOT DETECTED; DETECTION LIMIT WAS 2.8 PPB

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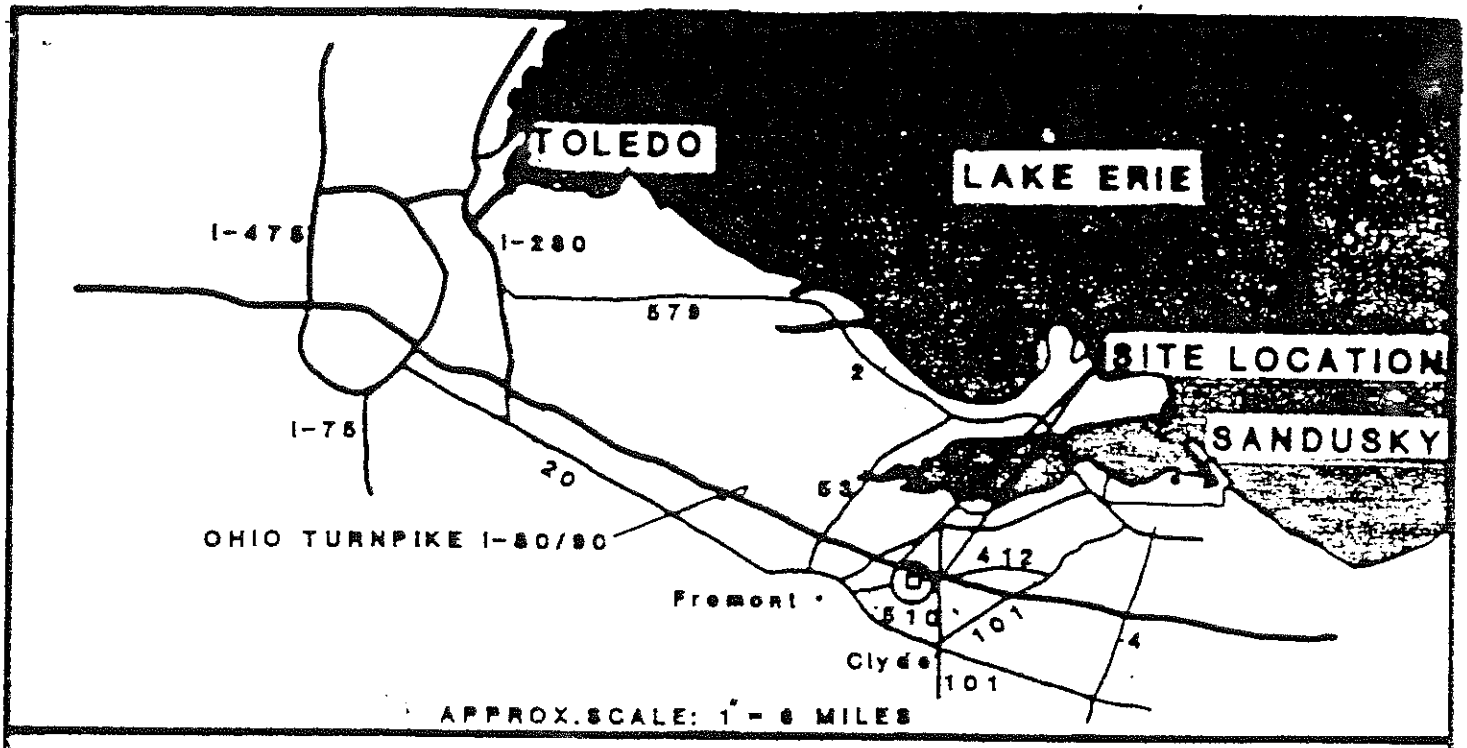
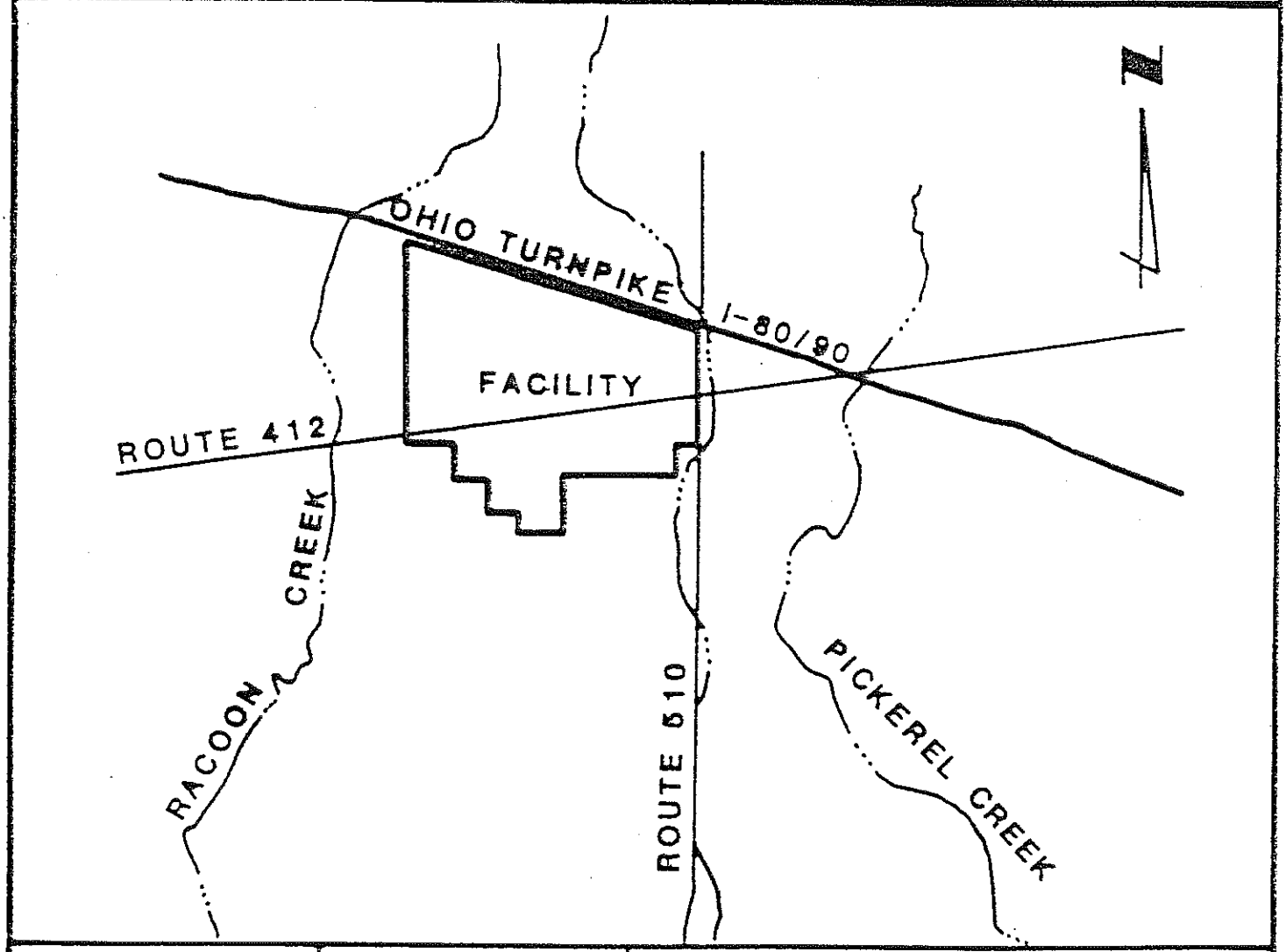
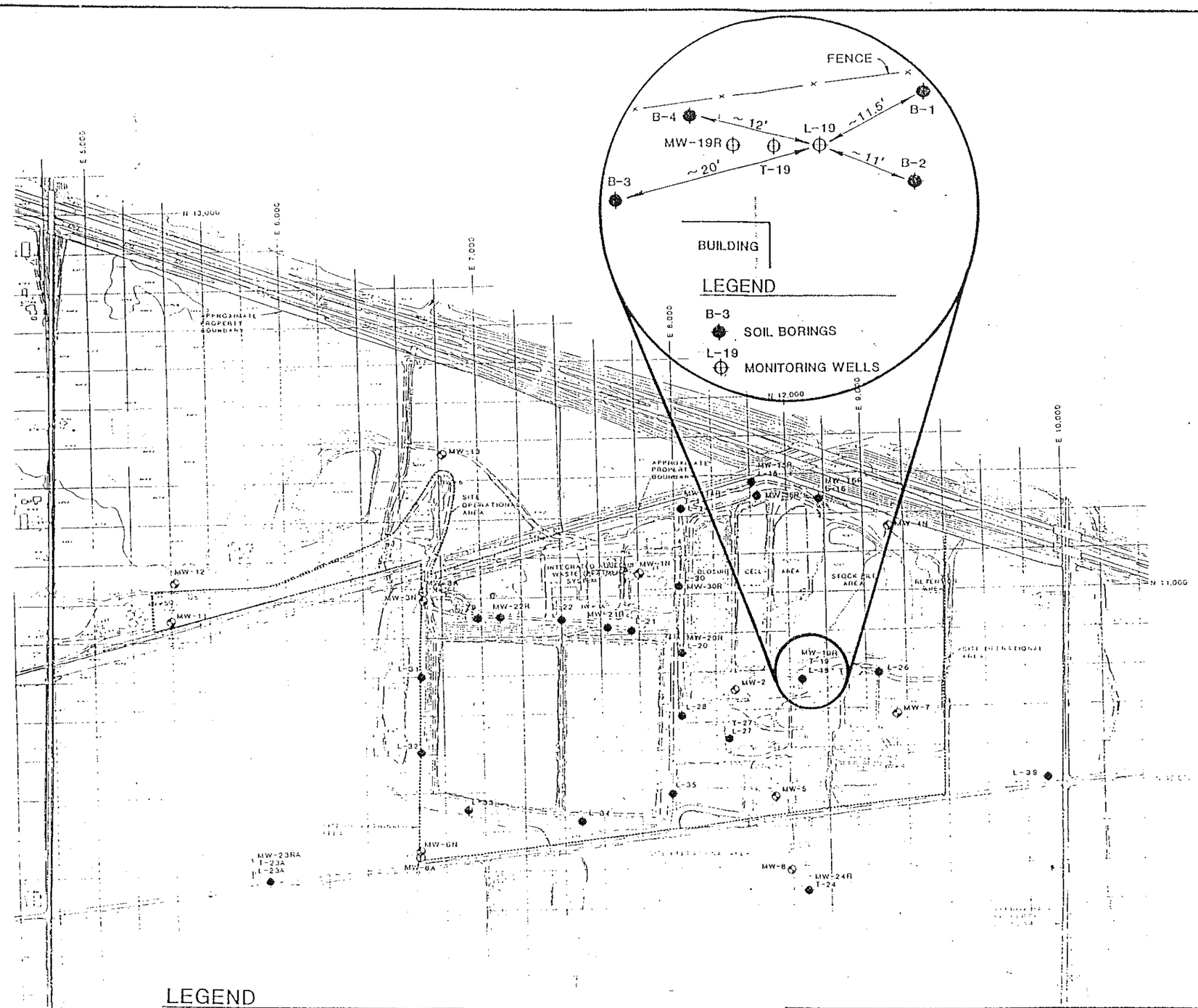
TABLE 4
SUMMARY OF GROUNDWATER MONITORING RESULTS FOR WELL L-19

	April 86	October 86	April 87	October 87	April 88	October 88	April 89	October 89	April 90
Concentration of 1,2-dichloroethane (1,2-DCA) (ppb)	10.1/8.81	12.1	9.1	7.27	7.31	8.62	9.26	8.98	7.9





JOB NO. 834-1358	SCALE NO SCALE	SITE LOCATION PLAN	
DRAWN JLW	DATE 3/13/86		
CHECKED WAD	DWG. NO. 391		
Golder Associates	CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 1	



NOTES
1. BASEMAP PROVIDED BY CHEMICAL WASTE MANAGEMENT, INC. DATE OF AERIAL PHOTOGRAPHY MARCH, 1985.
2. COORDINATES ARE APPROXIMATE TO THE NEAREST 5 FEET AND ARE BASED ON FIELD LOCATIONS OF THE WELLS. IN WELL GROUPS, WELLS ARE SPACED 3 FEET APART AND ARE GIVEN THE SAME COORDINATES.
3. MW-38R, T-38 AND L-38 WELLS ARE NOT PART OF THE RCRA MONITORING SYSTEM.
4. WELL MW-1N WAS DECOMISSIONED MARCH 1988

WELL NUMBER	EASTINGS	NORTHINGS
L-14	8,035	11,435
L-15	8,410	11,560
L-16	8,780	11,470
L-17	8,670	10,550
L-20	8,020	10,700
L-21	7,760	10,820
L-22	7,405	10,880
L-23A	5,890	9,582
L-26	9,065	10,580
L-27	8,265	10,250
L-28	8,020	10,360
L-29	6,980	10,960
L-30	8,020	11,045
L-31	6,680	10,600
L-32	6,685	10,210
L-33	6,935	9,915
L-34	7,500	9,840
L-35	7,970	9,960
L-39	9,915	10,020
MW-2	8,300	10,560
MW-5	8,515	9,950
MW-7	9,155	10,360
MW-8	8,600	9,586
MW-11	5,395	10,905
MW-12	5,400	11,105
MW-19	6,825	11,740
MW-19R	6,710	11,040
MW-19A	6,670	9,680
MW-19B	7,610	11,116
MW-20	8,710	10,950
MW-20R	9,130	11,130
MW-6R	6,670	9,730
MW-13R	8,035	11,435
MW-15R	8,410	11,560
MW-16R	8,780	11,470
MW-17R	8,670	10,550
MW-20R	8,020	10,700
MW-21R	7,640	10,840
MW-22R	7,045	10,900
MW-23RA	5,890	9,582
MW-23R	8,680	9,475
MW-37R	9,780	8,500
MW-38R	9,780	8,495
T-14	8,035	11,435
T-19	8,670	10,550
T-23A	5,890	9,582
T-24	8,680	9,475
T-27	8,265	10,250
T-37	9,780	8,500
T-38	9,780	8,495
[illegible]	8,020	11,045
[illegible]	8,410	11,492

SCALE IN FEET

LEGEND

- EXISTING BEDROCK MONITORING WELLS
- EXISTING OVERBURDEN MONITORING WELLS
- "RCRA 265" MONITORING WELLS
- MW-19R DESIGNATES BEDROCK WELLS
- T-19 DESIGNATES TILL WELLS
- L-19 DESIGNATES LACUSTRINE WELLS

Golder Associates
Atlanta, Georgia

CLIENT/PROJECT
CHEMICAL WASTE MANAGEMENT, INC.

DRAWN	CHECKED	REVIEWED
JLW		

TITLE
WELL L-19 INVESTIGATION LOCATION

DATE	SCALE	JOB NO.
7/19/90	AS SHOWN	853-3027
FILE NO. 834-1358	DWG. NO. / REV. NO. 629	FIGURE 2

317526

A3.8

Golder Associates Inc.
CONSULTING ENGINEERS

WORK PLAN FOR INVESTIGATION AT WELL L-19 VICKERY FACILITY

Submitted to:

Chemical Waste Management, Inc.
3956 State Route 412
Vickery, Ohio 43464

DISTRIBUTION:

5 Copies - Chemical Waste Management, Inc.
1 Copy - Dave Coker, CWM
2 Copies - Golder Associates Inc.

February 1990

Golder Associates Inc.
CONSULTING ENGINEERS

February 7, 1990 853-3026.3

Chemical Waste Management, Inc.
3956 State Route 412
Vickery, Ohio 43464

Attn: Mr. Steve Lonneman

RE: INVESTIGATION AROUND WELL L-19
VICKERY FACILITY

Gentlemen:

Golder Associates Inc. is pleased to submit this Work Plan for the investigation around Well L-19. We appreciate the opportunity to be of service to CWM. If you have any questions or need additional information regarding this work plan, please call.

Very truly yours,

GOLDER ASSOCIATES INC.

Gary H. Collison, P.E.
Principal

GHC/dah
enclosure

TABLE OF CONTENTS

1.0 INTRODUCTION

Chemical Waste Management, Inc. (CWM) owns and operates a hazardous waste disposal facility in northern Ohio, near the town of Vickery, known as the Vickery Facility. The site is located on State Route 510, about twenty miles southwest of Sandusky, Ohio (Figure 1).

The facility presently disposes of hazardous waste by underground injection through four deep wells. Three other deep injection wells previously used at the site have been plugged and abandoned. Past operations at the facility also included the use of various ponds for the treatment and/or separation of oil residues and liquid waste for reclamation and disposal.

Well L-19 has been monitored in accordance with the Consent Agreement and Final Order (CAFO) between CWM and the United States Environmental Protection Agency (U.S.EPA), effective April 5, 1985. Well L-19 monitors the lacustrine soils above the aquifer and is located in the southeast portion of the facility. Analyses of groundwater samples obtained from well L-19 have indicated the presence of 1,2-dichloroethane (1,2-DCA). As a result, and as discussed in correspondence of October 16, 1989, and January 18, 1990, between CWM and the Ohio Environmental Protection Agency (OEPA), CWM proposes herein to perform an investigation of the potential source of the 1,2-DCA detected. This plan details the procedures for investigating the source of the compound detected and the installation of an additional monitoring well in the area of well L-19.

2.0 GEOLOGY AND HYDROLOGY

2.1 General

The site geology and hydrogeology have been extensively evaluated and summarized in References 1 through 6. The site is underlain by approximately 33 feet to 52 feet of glacial overburden materials, consisting of lacustrine clay and glacial till, overlying dolomite bedrock. The dolomite bedrock, which comprises the uppermost aquifer underlying the site, is about 500 feet thick. The dolomite bedrock is underlain by a sequence of sedimentary rocks comprising shale, sandstone, limestone, and dolomite. Precambrian granite bedrock ("basement rock") is encountered about 2,900 feet beneath the ground surface.

2.2 Overburden Soils

The overburden soils at the site are the primary soils of concern in this investigation. The overburden soils consist of deposits of glacial and lacustrine silty clays and clays, approximately 50 feet thick.

The lacustrine soils extend from 0 feet to 25 feet beneath the ground surface, with a typical thickness of about 15 feet. Sand partings and horizontal laminations 1/4-inch to 1-inch thick have been observed in the lacustrine materials. The upper 5 feet to 10 feet of the overburden has been desiccated during the geologic past resulting in fractures which may be open, although none were observed during any of the field sampling programs.

Glacial till deposits underlie the lacustrine materials down to bedrock. These till deposits are also comprised of silty clays and clays, with some sand and gravel in the matrix. In some areas of the site, the till deposits are at or near the ground surface. In these areas, some desiccation of the near surface till soils has also occurred.

The depth of desiccation can be delineated by lower moisture contents and stiffer consistencies than those found deeper in the overburden. Below the limit of desiccation the lacustrine and till soils are typically soft, have a relatively high moisture content, and are near normally consolidated. These soft soil conditions posed particular installation problems for the SS-series holes because the clays would squeeze the hole closed, unless casing was used to support the hole.

2.3 Hydrogeology

The primary aquifer underlying the site is the fractured and solutioned dolomite bedrock. Site water level data indicate on-site pumping from the aquifer can affect the overall groundwater gradients. Furthermore, an on-site pump test, along with past water level data, has clearly demonstrated that lateral flow in the aquifer can locally be maintained toward the facility. Regional lateral flow in the aquifer is north toward Lake Erie.

Water levels in the bedrock aquifer, within the area of this study, are approximately at an elevation of 595 feet; about 15 feet to 20 feet beneath the original ground surface.

Water levels in the overburden materials have been observed to be within 5 feet of the original ground surface. Therefore, there is a component of flow from the overburden material toward the bedrock aquifer. However, the amount of flow through the overburden materials at the site is probably inconsequential compared to the amount of total bedrock aquifer recharge from off-site areas.

3.0 PROPOSED INVESTIGATION

3.1 Drilling

The proposed investigation includes the drilling of four boreholes, analysis of soil and groundwater samples from the boreholes and the subsequent installation of one well. As per CWM's proposal, and at OEPA's request, the holes will be drilled approximately 10 feet from the location of well L-19 (see Figure 2), and to the same depth as well L-19. As shown on Figure 2, the proposed borings are located northwest, northeast, southwest and southeast of well L-19. These locations were chosen to avoid the other wells in the area. The boring to the northwest is approximately eight feet from L-19 to avoid crossing the fence line. The well installation log for well L-19 is included in Appendix A. A Health and Safety Plan for this program is provided in Appendix B.

3.2 Soil and Groundwater Sampling

Each hole will be continuously split-spoon sampled to the same depth as well L-19, 21.9 feet below grade. Soil samples will be retained from each split-spoon in two 40-mL borosilicate glass vials with teflon septum caps and in one one-pint glass jar. The 40-mL vials will be filled with soil (minimizing headspace), labeled, and placed in a shuttle with ice packs. The pint jar will be filled with soil to approximately 3/4 full, the jar opening will be covered with aluminum foil, the lid will be screwed on, the jar will be shaken, and then will sit for at least 15 minutes. The headspace in each pint jar will be analyzed in the field to determine the total volatile organic concentration (TVOC) using a Foxboro, Century 128, Organic Vapor Analyzer (OVA). The probe on the OVA will be used to puncture the aluminum foil and the relative TVOC reading will be recorded.

Upon completion of the field soil testing, the vial samples corresponding to the ten jar samples with the highest TVOC readings will be sent to Environmental Testing and Certification Corporation (ETC) for analysis for 1,2-DCA. If less than ten samples indicate

the presence of volatile organic compounds (VOCs), then enough additional samples will be chosen at random for analytical testing to have a minimum of ten analyzed.

In addition to soil sampling, groundwater samples will also be collected from the investigation borings. Following completion of the boreholes, the augers will be removed and the borehole covered with plastic to keep debris and precipitation from entering the holes. The day following completion, the groundwater will be removed, to the extent possible, using a PVC bailer. The PVC bailer will be decontaminated between use in different borings. Once the groundwater has been removed, each boring will be covered to allow the groundwater to refill the boring. A groundwater sample will then be collected from each boring and placed in two volatile organic analysis (VOA) vials. Samples will be collected with a stainless steel bailer which will be decontaminated between use in different borings. The groundwater samples will be sent to ETC for analysis for 1,2-DCA. Following groundwater sample collection, each boring will be backfilled with bentonite pellets or grout.

3.3 Well Installation

Based on the results of the soil and groundwater sample analyses, a location near well L-19 will be chosen for the installation of an additional monitoring well. The monitoring well will be installed using the same procedures used for installing well L-19, as described in Reference 7, and will be suitable for inclusion in the facility's groundwater monitoring program.

Generally, the well will be constructed using surface casing and temporary casing to minimize dragdown and to minimize flow of surface or near surface water into the well during drilling. Also, extensive decontamination procedures will be followed to minimize contamination from the drilling equipment. The well will be constructed of 2-inch diameter, 316 stainless steel, flush threaded joint pipe. The well screen will be number 6 slot size and will

be installed to the same depth and length as well L-19 (Appendix A). Details of the well drilling, decontamination and construction procedures are included in Appendix C.

3.4 Well Development

The well will be developed following installation by successive purging of the well water. Based on previous experience with shallow overburden wells at the site, a period of 3 days may be required for a well to recover after purging. Purging will continue until reasonably stable pH and specific conductance values are obtained. The well will be purged once before or at the completion of the installation program after several feet of water have accumulated in the well and at least one other time before sampling. Additional purging for development may be required. Development and pumping water will be collected for on-site disposal.

3.5 Reporting

At the completion of this sampling and well installation program, a report on the program will be provided. This report will include a description of the soil drilling and sampling, field sample analyses results, well installation details, sampling and analytical protocol, analytical results, and an evaluation of the results.

3.6 Timing

This evaluation program for well L-19 will be initiated within 30 days after approval of the plan by the OEPA. The final report will be submitted within 30 days after receiving the final laboratory analytical reports for the proposed soil and water sampling.

GOLDER ASSOCIATES INC.

Wendy D. Morris
Project Engineer

Gary H. Collison, P.E.
Principal

WDM/GHC:maa

REFERENCES

1. Bowser-Morner, Inc. "Hydrogeologic Assessment, Northern Ohio Treatment Facility, Vickery, Ohio", May 1983.

2. Golder Associates, "Geotechnical and Geohydrologic Data Review, Vickery, Ohio, Chemical Waste Management Facility", June 1983.

3. Golder Associates, "Summary and Characterization of Site Geohydrologic Conditions, Chemical Waste Management, Inc., Vickery, Ohio Facility", September 1983.

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5. Golder Associates, "Overburden Groundwater Testing Program Description", June 1984 and Addendum dated July 2, 1984.

6. Golder Associates, "Overburden Groundwater Testing Program, Vickery, Ohio Facility", September 1984.

7. Golder Associates, "Phase I Groundwater Monitoring Program, Chemical Waste Management, Inc., Vickery, Ohio Facility", March 1986.

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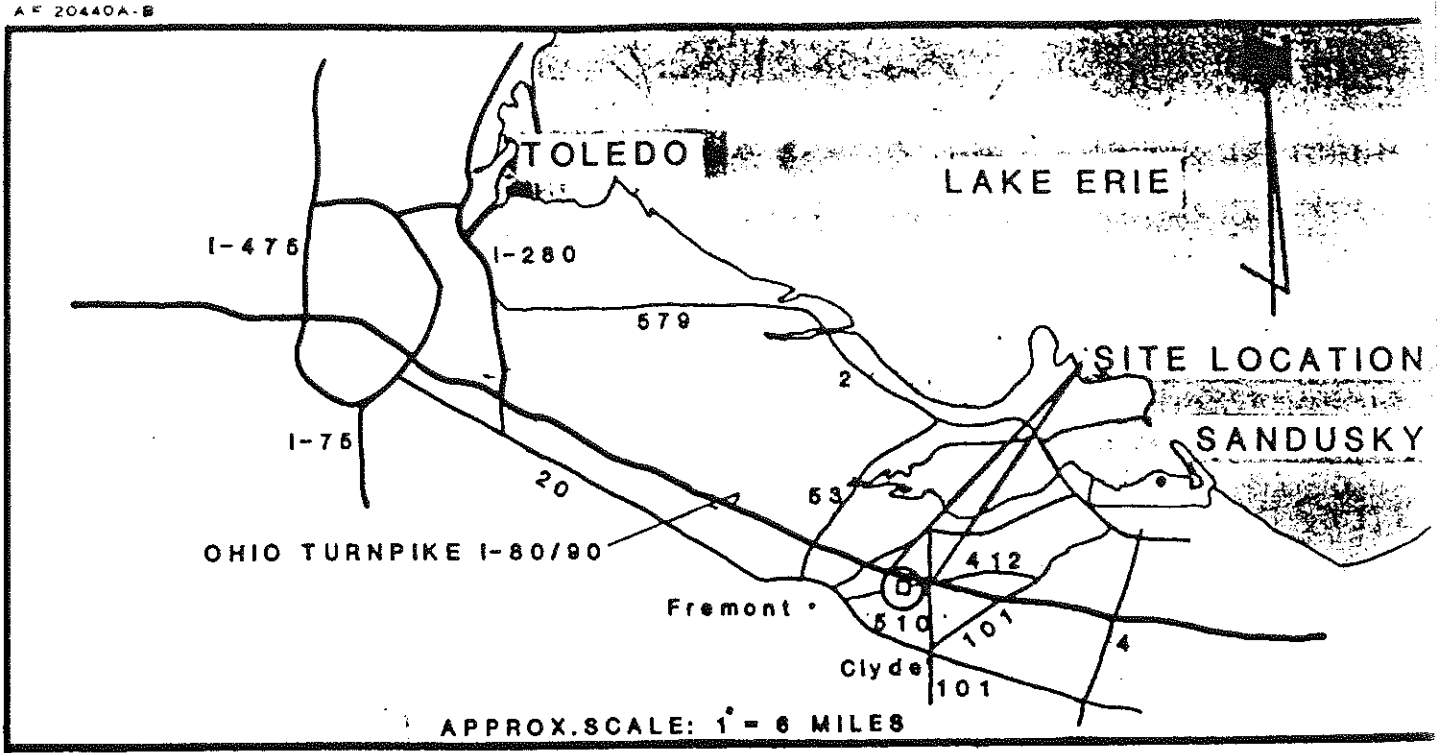

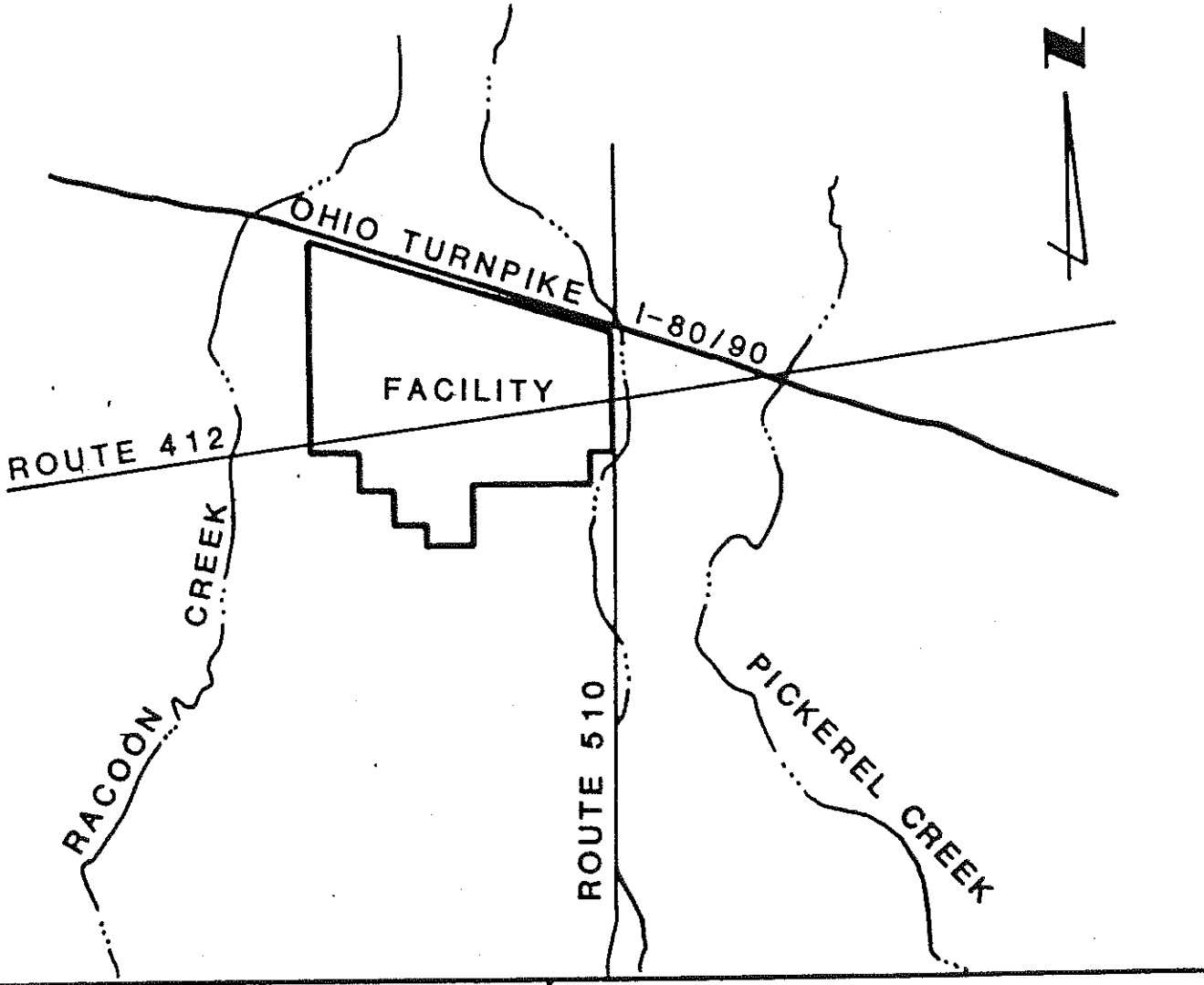

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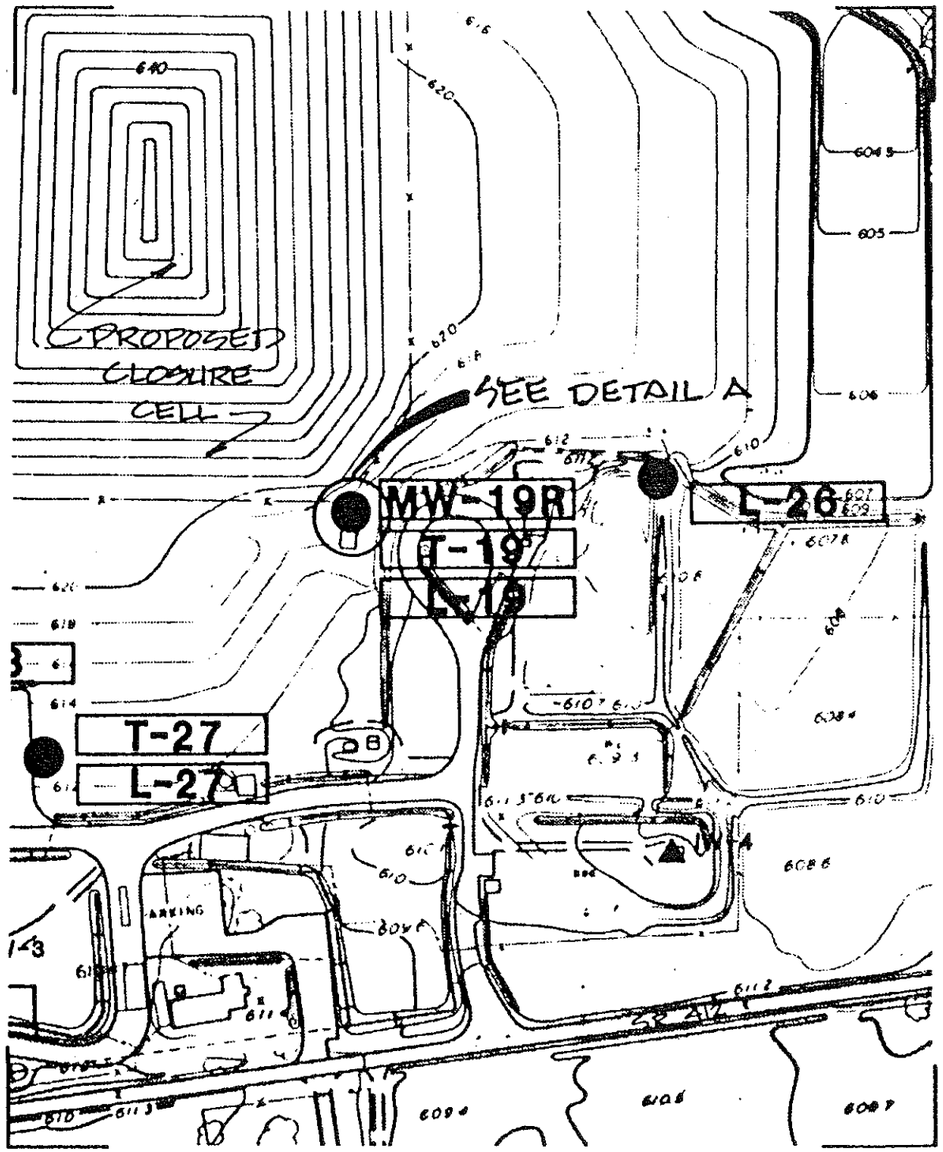
CHECKED WHA	DWG. NO. 391	
Golder Associates	CHEMICAL WASTE MANAGEMENT, INC.	FIGURE 1



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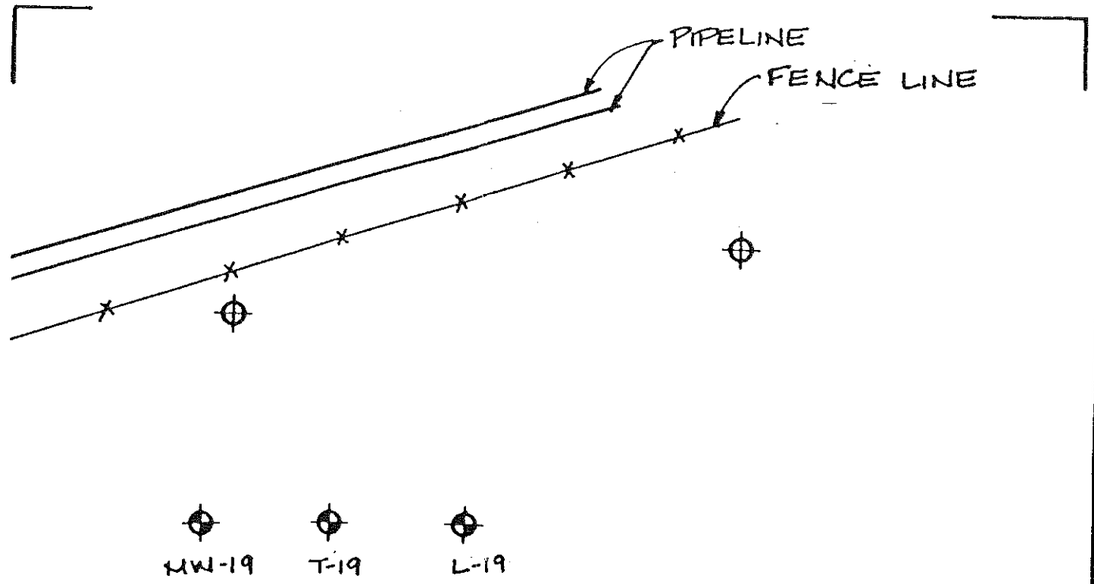


DETAIL A

LEGEND
- MONITORING WELL
- PROPOSED BORING LOCATION

APPROX. SCALE IN FEET
0 4 8

Golder Associates
Atlanta, Georgia

CLIENT/PROJECT
CHEMICAL WASTE MANAGEMENT, INC.

TITLE
WELL L-19 PROPOSED INVESTIGATION BORING LOCATIONS

DRAWN	CHECKED	REVIEWED	DATE	SCALE	JOB NO.
EAH	JFD	JFD	2/2/90	AS SHOWN	853-3026.3

FILE NO.	DWG. NO. / REV. NO.	FIGURE
824-1358	628	2

313423

APPENDIX A

MONITORING WELL INSTALLATION LOG

MONITORING WELL INSTALLATION LOG

JOB NO. 853-3020 PROJECT CWM / VICKERY / OU WELL NO. C-19 SHEET 1 OF 1
GA INSP. C.E. JDC DRILLING METHOD AUGER / ROTARY GROUND ELEV. 616.5 WATER DEPTH 11.52'
WEATHER SUNNY DRILLING COMPANY BOWSER MORNER COLLAR ELEV. 617.87 DATE/TIME 10/22/85 12:00
TEMP. — DRILL RIG CME 55 DRILLER T. ROEHNER STARTED 1025/85 (TIME / DATE) COMPLETED 1445 10/28/85 (TIME / DATE)

MATERIALS INVENTORY

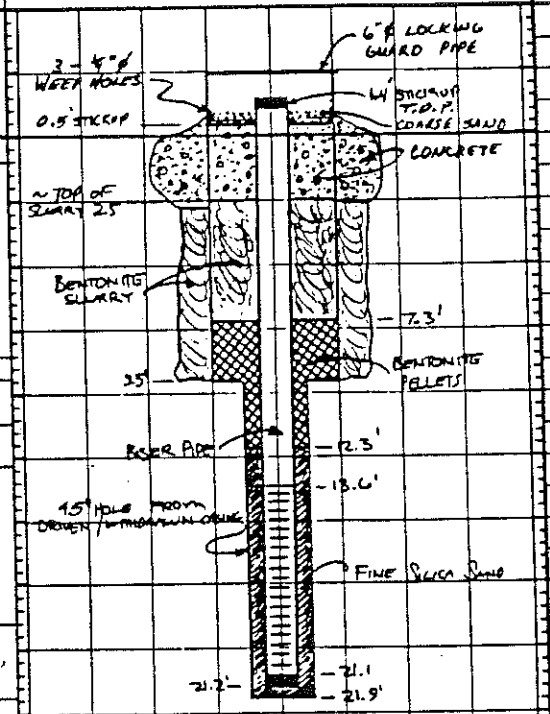
WELL CASING 2 in. dia. 15.0' LF
CASING TYPE 316 STAINLESS STEEL
JOINT TYPE FLUSH COUPLED
GROUT QUANTITY —
GROUT TYPE BENTONITE SLURRY

WELL SCREEN 2 in. dia. 7.5' LF
SCREEN TYPE 316 STAINLESS WIRE WOUND
SLOT SIZE 0.0060 in
CENTRALIZERS NONE
DRILLING MUD TYPE NONE

BENTONITE SEAL PELLETS
INSTALLATION METHOD GRAVITY FALL
FILTER PACK QTY ~5.5 GALS
FILTER PACK TYPE FINE SILICA SAND
INSTALLATION METHOD GRAVITY FALL

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
	GROUND SURFACE
0.0	
1.0	FIRM TO STIFF, BROWN-TAN, CLAYEY SILT, LITTLE F-C SAND, LITTLE F-C GRAVEL (FILL)
8.5	FIRM, BLACK-BROWN-TAN CLAYEY SILT, TRACE ORGANICS
9.4	FIRM TO STIFF, GRAY-TAN, MOTTLED, SILTY CLAY, TRACE FINE SAND (LACUSTRINE)
11.2	LOOSE TO COMPACT, BROWN SILT, SOME FINE SAND (LACUSTRINE)
12.8	SOFT TO STIFF, TAN-GRAY, LAMINATED SILTY CLAY, TRACE FINE SAND (LACUSTRINE)
19.0	SOFT TO HARD, GRAY SILTY CLAY, TRACE F-C SAND, TRACE F-C GRAVEL (TILL)
21.9	

WELL SKETCH



INSTALLATION NOTES

Attached

WL 10.1 BGS

WELL DEVELOPMENT NOTES

WELL DEVELOPED BY BAILING AND SURGING WITH 1" ϕ STAINLESS STEEL BAILER.

BAILER AND TEFLON CHECK VALVE WAS STEAM CLEANED AND RINSED WITH DEIONIZED WATER BEFORE DEVELOPMENT.

TOTAL VOLUME REMOVED DURING DEVELOPMENT WAS APPROX. 8-9 gallons

CAPACITY OF WELL WHEN STATIC W.L. IS 11.47' (1-14-86) BELOW TOP OF RISER IS 1.9 GALS.

MEASUREMENTS DURING DEVEL.

DATE	GALLONS BAILED	PH	SPECIFIC COND.	COMMENTS
11-15-85	2.0	6.4	7,500	
11-17-85	2.2	6.5	7,300	WATER MILKY
11-19-85	2.2	6.7	6,700	SLIGHTLY TURBID
11-21-85	2.0	—	—	RECOVERY TEST PERFORMED

STATIC W.L 1-14-86 WAS 11.47'

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SUBJECT: WELL INSTALLATION NOTES

Job No. 853-3020 | Made by JCC | Date 11-6-85

Ref. L-19 | Checked | Sheet 1 of 2

Reviewed GJR

1. a) Augered 10"Ø hole to 9.5' bgs. Sounded hole at 8.9'. Reaugered to 9.5' Sounded hole at 9.5'

b) Set 10' 6"Ø surface casing bottoming @ 9.5'.

c) Grouted borehole annulus (between 6" casing and 10" auger hole) with a bentonite grout slurry. Used 20 gallons of bentonite bottling ~ 5 gal overflow.

d) 6"Ø casing was drilled and flushed to 9.5 until clean. Bailed to within 0.5' of bottom of hole.

2. a) Drove 4"Ø casing from 9.5' to 15.0'. Drilled and flushed clean. Sounded hole at 14.9'. Hammered casing from 14.9' to 21.9' Drilled and flushed clean. Bailed water to within 0.5 of bottom. Sounded @ 21.9

b) Pulled 4"Ø casing up a foot. Sounded at 21.9. Added 0.7' of sand. Set 7.5' screen and 5.0' of riser pipe. Stickup of riser pipe is 1.3'. (0.1 ft at end cap on bottom of screen)

c) Backfilling: 4"Ø casing was pulled up a foot at a time and added sand. Sounded each time to ensure no sloughing of hole or sand bridge had occured. Backfilled sand to 12.3' bgs. Calculated amt. of sand used was ~ 5.7 gals. Sample of sand was taken.

d) 4"Ø casing was pulled up a foot and pellets were added up to 7.3', pulling up a foot at a time and sounded to ensure no sloughing or bridging had occured. Volume of pellets used was ~ 4.4 gal. (calculated).

e) Remaining open borehole annulus was filled with bentonite slurry to ground surface.

3. a) Water level upon completion was 11.52' @ 1200 on 10/28/85.

4. a) Aluminum 6"Ø Protectaire flush joint pipe was threaded on to the 6"Ø surface casing and secured with a lock.

5. a) The well cap was vented by drilling a small hole in the cap.

6. a) A 30' hole was hand dug around the 6"Ø surface casing and was filled with concrete. Sloped so water would run away from well.

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SUBJECT WELL INSTALLATION NOTES

Job No. 85s-3020 | Made by LC | Date 11-6-85

Ref. L-19 | Checked | Reviewed JBC | Sheet 2 of 2

7. a) Three ¼" diameter drain holes were drilled near top of cement mound. Bentonite grout was taken out of the 6" Ø surface casing to 2.5' below ground surface. Cement was added to replace the grout removed.

b) Coarse sand was poured on top of the hardened cement to about 5 inches below the top of well pipe.

APPENDIX B

HEALTH AND SAFETY PLAN

B.0 HEALTH AND SAFETY PLAN

B.1 General Safety Precautions

At the Vickery Facility, CWM maintains Safety Regulations for Outside Contractors. These regulations will be strictly enforced and will provide the minimum Health and Safety requirements for the site. The specific work activities outlined in this Investigation Plan will require additional Health and Safety precautions.

A volatile organic compound was reportedly detected in L-19. The reported presence of this compound necessitates the use of an instrument in the field to trigger the use of respiratory protection. The following procedures will be followed.

1. CWM Safety Regulations will be followed.
2. Personnel in the working area handling drilling or sampling equipment, handling samples, or handling cuttings shall wear hard hat, gloves, tyvek suit and safety boots.
3. Upon leaving the work area, thoroughly wash face and hands.
4. A respirator, with organic vapor cartridge, shall be carried by personnel within the work area.
5. Respirtory protection will be worn when required as delineated below.

During drilling and sampling, air quality will be monitored continuously with an OVA, HNU, or Photovac TIP. The air quality detector shall be calibrated daily and the calibration documented. Air quality readings shall be recorded at a minimum of once per hour during the course of the work. Any unusual or anomalous readings shall be also be recorded on the air quality monitoring data sheet or field book along with date, time, and location. A portable wind sock or wind vane shall be established at each work station and, where possible, personnel shall stay upwind of the drilling and sampling operations.

As previously noted, it is contemplated that the assessment work will only require Level D personnel protection. However, equipment will be provided for Golder Associates and drilling contractor personnel to continue the planned work with Level C personnel protection, should such protection be necessary as determined by air quality measurements. Should air contaminant levels require Level B protection, the project will stop until such equipment can be brought to the site. The total atmospheric concentrations of vapors or gases for determining personnel protection levels are as follows:

Level D - Background to 5 ppm
Level C - 5 ppm to 50 ppm above background
Level B - 50 ppm to 500 ppm above background
Evacuate working area @ > 500 ppm

The personnel protection equipment for the different levels of protection are presented in Table B-1.

B.2 Procedures if Hazardous Materials are Encountered

Sampling of hazardous waste products or containers, or penetration of these materials is not proposed as part of this program. However, in the event that the drilling does encounter hazardous materials or the air monitoring indicates that supplied air respiratory protection to be required, the following steps will be taken:

1. Drilling and sampling work shall cease.
2. All personnel will immediately move a safe distance (at least 50 feet upwind) from the work area.
3. Air quality measurements will immediately be checked to determine a safe working area.
4. The appropriate respiratory protection level shall be determined from air quality measurements as specified in Section B.1.

5. Personnel may return to the work area with the appropriate respiratory protection and protective clothing.

6. All potentially contaminated material from the hole shall be drummed for off-site disposal.

TABLE B-1

PERSONAL PROTECTIVE EQUIPMENT

Levels D, C, B and A

LEVEL D: - FID/PID from 0 to 5 ppm

Tyvek Coveralls
Safety Boots
Hard Hat
Safety Glasses or Goggles

LEVEL C: - FID/PID from >5 to 50 ppm

Air-purifying Respirator (MSHA/NIOSH Approved)
Safety Glasses, Goggles or Face Shield
Tyvek Coveralls
Inner Gloves - Surgical Type
Outer Glvoes - Chemical Resistant
Hard Hat
Boots - Chemical Resistant

LEVEL B: - VOA/PID from >50 to 500 ppm

Full Face Positive Pressure Air Respirator
(MSHA/NIOSH Approved)
Saranex Coated Tyvek Coveralls
Inner Gloves - Surgical Type
Outer Gloves - Chemical Resistant
Boots - Chemical Resistant
Hard Hat
Cloth Coveralls Inside Tyvek

LEVEL A: - VOA/PID >500 ppm

Not anticipated; procedures will be developed, if required.

NOTE: Ambient air quality monitoring readings are Work Zone-Guidelines Values

APPENDIX C

INSTALLATION PROCEDURES FOR NEW MONITORING WELLS

C.0 INSTALLATION PROCEDURES FOR NEW MONITORING WELLS

C.1 General

New groundwater monitoring wells for the Vickery Facility monitoring system are designed and installed based on the subsurface stratigraphy of the area. To the degree practical, the well screen slot sizes have been selected to maximize the open interval while providing small enough openings to keep fine grained soil particles from entering the wells.

The installation procedures are tailored to minimize dragdown of potentially contaminated surface soils, to minimize potential flow of surface or near surface water into the well while drilling, and to minimize potential cross contamination between wells from the drilling equipment. The installation methods have also been selected to prevent hole collapse or squeezing, which hampered previous well and piezometer construction at the facility. To accomplish these goals, surface casings and temporary casings will be used to construct each well and extensive cleaning procedures for the drill rigs, drilling tools, casings, and well materials will be adopted.

C.2 Equipment Cleaning and Decontamination

Prior to drilling a well boring, all equipment, including the "working areas" of the drill rig, will be steam cleaned and degreased until all loose material is removed. Drilling tools such as drill rods, 6-inch steel surface casing, 4-inch temporary steel casing and drill bits will be steam cleaned, then rinsed with laboratory grade acetone and immediately re-rinsed with steam. The second steam rinse is intended to follow the acetone application before the acetone could evaporate. A third steam rinse is generally applied as an additional precaution.

Cleaned equipment not used immediately will be wrapped with plastic to protect equipment from airborne particulate matter. The ends of all casing and drill rods will be wrapped in plastic to keep

particulate matter out of the interior of the drilling equipment. Any tape used to secure plastic to the materials will be applied so that it will not contact the materials directly. Cleaned equipment and equipment at each well site will be covered with plastic until needed for well construction purposes.

All open boreholes or drill casing left in boreholes will be covered with plastic when left for extended periods of time or during precipitation events. Such covering is done to protect the inside of the well bore from airborne particulate contamination.

All water used for cleaning and well construction will be municipal water. A sample of this water, along with rinse or wash water samples (from cleaned well and drilling materials) will be tested for selected priority pollutant organics.

C.3 Drilling Procedures

All wells will be constructed in steps by installing surface casing and telescoping a borehole through the surface casing to the final well depth. This telescoping will minimize the potential for dragdown of possibly contaminated surface soil or near surface waters.

Well borings will generally begin by augering a nominal 10-inch diameter borehole with solid stem augers to within one to four feet of the proposed top of screen interval for the wells. A 6-inch diameter flush threaded steel casing will be placed into the borehole with approximately 0.5 feet of the pipe (threaded end) extended above the existing ground surface. Grout mixed for all grouting procedures will consist of a Wyoming bentonite clay and municipal water mixture at a consistency of 1.5 to 2.0 pounds of bentonite per 1.0 gallon of water.

Grout will be tremied down the annular space between the 10-inch diameter augered hole and the 6-inch diameter surface casing. The grout slurry will be mixed with either a Moyno pump, air driven bladder pump, or by hand, if applicable.

The 6-inch surface casing will be flushed and/or drilled out (reamed) by using a 5.88-inch roller bit and municipal water until the return water is clear. After flushing, the remaining water will be removed to within 6 inches of the bottom of the hole by bailing with a 3-inch diameter PVC bailer, or by pumping with either the rig pump or a contractors pump. A one-way check valve will be placed at the intake point when a pump is used to remove water downhole. The depth of the hole and residual water will be measured with a calibrated tape after the removal of water.

Advancement of the borehole will then be performed by driving a 4-inch inside diameter flush threaded steel casing through the 6-inch diameter surface casing to the desired well depth. The interior of the 4-inch casing will be flushed and reamed thoroughly with municipal water at selected intervals. The 4-inch casing will be bailed to within 6 inches of the bottom of the hole.

Soil samples will be obtained at specified depth using a split spoon sampler. The sampler will be driven inside the casing at each interval and then hole advancement will continue.

C.4 Well Completion

After advancing the well borings to the prescribed depth with the 4-inch diameter temporary casing, the following steps will be performed to complete the installation of wells screened in the soils:

a) A 6-inch layer of fine silica sand consisting of fine silica sand with less than 5 percent passing the number 200 U.S. Standard sieve will be poured into the borehole. The 4-inch diameter steel temporary casing will then be withdrawn 6 inches to one foot.

b) The well screen and riser pipe will be placed in the borehole, resting on the 6-inch layer of filter sand. The well riser extension above ground surface will be measured to assure that a proper stickup of about 1.0 feet to 3.5 feet. Well pipe and screen will be handled while wearing clean, laboratory grade laytex gloves. The well screen and pipe will consist of 316 stainless steel 2-inch diameter, flush threaded joint pipe. Well screens will be continuously wrapped to number 6 slot (0.006 inches) size.

c) The 4-inch temporary casing will be pulled in about one foot increments with about one foot of fine filter sand added for each increment. The depth to the top of the sand will be measured before and after the casing is pulled to detect any collapse of the borehole.

d) Once the sand is installed to between 0.5 feet and 1.0 feet above the top of the screen, the 4-inch temporary casing will be pulled in short increments (0.3 feet to 1.0 feet) and 3/8-inch diameter bentonite pellets will be added, tamped, and measured for each increment withdrawn. About 2 feet to 3 feet of pellets will be placed in the wells.

e) The remaining annular space will be grouted with a bentonite slurry mixture to within 2.5 feet of ground surface.

f) A 6-inch diameter flush joint protective casing and cover will be threaded onto the surface casing immediately after completion of the well. The cover should be then secured with a lock.

g) A 30-inch deep hole will be hand dug around the 6-inch diameter surface casing and backfilled with concrete to about 3 inches above the base of the protective pipe. The concrete will be sloped to provide surface drainage away from the well.

h) Well caps will be installed on the top of each well pipe. All well caps will be vented by drilling a small diameter hole through the side of the caps.

i) Dedicated stainless steel bailers will be later installed inside each well.